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HOT LYNX II SPORT!

47380

December 1990

Radio Control CAR ACTION

THE WORLD'S PREMIER R/C CAR MAGAZINE



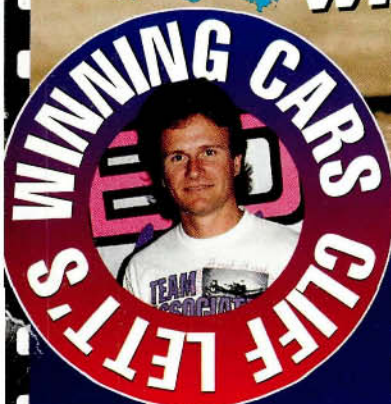
**ASK SANTA...
CHRISTMAS
WISH
LIST**

**PRODUCT INFO
CATALOGUE
COLLECTION**

NATS

WINNER...

**TRAXXAS
EAGLE**



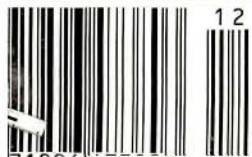
**SHOCK
WAVE**

**OFF-ROAD
WHEEL
ROUNDUP**

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12





SPORTSMAN'S CUP, page 58

CONTENTS

Volume 5, Number 12

December 1990

FEATURES

38

CHRISTMAS WISH LIST

by Car Action Staff
Better not pout, better not cry...

44

INSIDE CLIFF LETT'S WINNING CARS

by Steve Pond
Sneak a peek at the cars that ROARed

58

SPEEDWORKS SPORTSMAN'S CUP

by Steve Pond
Dukin' it out in Detroit

80

MADCAP TRUCK CONVERSION

by Bill O'Brien
Bad Brain's madcap scheme

84

HOUGE RC10 CONVERSION

by Mike Lee
Make your RC10 deadly

93

NORRCA OFF-ROAD NATS

by Jim Shepka
Twisting, turning, dirt burning!

100

ROAR OFF-ROAD NATS

by Mike Lee
An off-roader's paradise in Livermore, CA?

115

CATALOGUE COLLECTION

by Car Action Staff
Let your fingers do the walking

124

BUILD A T-BUCKET

by Eric Goldschrafe
A classic little hot-rod

134

OFF-ROAD WHEEL ROUNDUP

by Car Action Staff
Get rolling!

146

SHOCK WAVES

by Car Action Staff
How to survive track tremors

68

TRAXXAS TRX-T EAGLE

by Chris Chianelli
This one soars!

COLUMNS

74

TROUBLESHOOTING

by Steve Pond
Dr. Pond's R/C remedies

108

DIRT DIGEST

by Bill O'Brien & Bob Kane
Defy the laws of physics!

8

LETTERS

10

PUBLISHER'S PAGE

by Louis DeFrancesco

12

READERS' RIDES

14

INSIDE SCOOP

by Chris Chianelli

54

PIT TIPS

by Jim Newman



LYNX II SPORT, page 32

TRACK REPORTS

19

ASSOCIATED RC10 CHAMPIONSHIP EDITION

by John Huber
Taste the victory!

32

COMPOSITECRAFT/TRC LYNX II SPORT

by John Huber
Cruise with a cat

130

SCOPING OUT

by John Rist
Tekin's new, high-tech TSC 411P

DEPARTMENTS

6

EDITORIAL

by Steve Pond

176

TRACK DIRECTORY

220

WHAT'S NEW

242

AD INDEX

ON THE COVER: upper right—TRC Lynx II Sport. Center: Team Associated's RC10 Championship Edition. (Photos by John Huber.) Upper left: the Traxxas TRX-T Eagle. Middle and lower left: Cliff Lett's Nationals-winning RC10 and Yokomo YZ-10. (Photos by Yamil Sued.)

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SUBSCRIPTION PRICES:
U.S. & Possessions (including APO & FPO):
1 year (12 issues) \$29.95
2 years (24 issues) \$54.95
Outside U.S.:
1 year \$39.95; 2 years \$74.95
Payment must be in U.S. funds.
Subscription Inquiries: Call 1-800-435-0715 (in IL,
1-800-892-0753)

RADIO CONTROL CAR ACTION (ISSN 0886-1609) is published monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897, USA. Connecticut Editorial and Business Office, 251 Danbury Rd., Wilton, CT 06897. Phone: 203-834-2900. FAX: 203-762-9803. Y.P. Johnson, President; G.E. DeFrancesco, Vice President; L.V. DeFrancesco, Secretary; Yvonne M. Micik, Treasurer. Second Class Postage Permit paid at Wilton, Connecticut, and additional Mailing Offices. Copyright 1990 by Air Age, Inc. All rights reserved.

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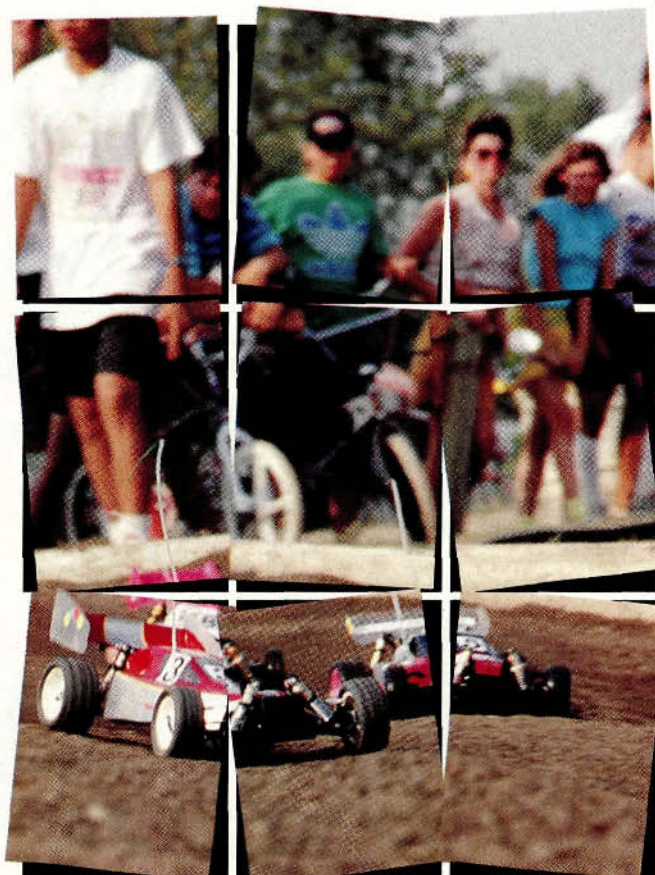
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POSTMASTER: Please send Form 3579 to *Radio Control Car Action*, P.O. Box 427, Mount Morris, IL 61054.

ON JUNE 26, 1990, APPLICATION FOR ABC (AUDIT BUREAU OF CIRCULATION) MEMBERSHIP WAS FILED BY R C CAR ACTION.

EDITORIAL

by STEVE POND



DO WE, AS RACERS, put too much emphasis on winning the A-Main? Many R/C enthusiasts don't really know what an A-Main is all about—they're content with thrashin' around the backyard. Those who do race formally, however, have been led to believe (by an elitist few) that they're just not "in the program" if they don't make the A-Main.

I've come to the conclusion that it doesn't matter whether you make the A-Main or not. At a race, your car is on the track for two or three heats (a total of 12 minutes) just to qualify. With other racers, you compete against the clock for places in a Main, and then you race against eight to 10 drivers with similar abilities. What more could you want?

Of course, there will be days when nothing goes your way, but if you're happy with your performance and you drove to the best of your ability, then the letter attached to your Main shouldn't matter. If you enjoy yourself, learn a couple of things and walk away smiling, you're ahead of the game (and those A-Main ogres)! ■

LETTERS

We welcome your comments and suggestions. Letters should be addressed to "Letters," *Radio Control Car Action*, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

MORE INTERVIEWS

I received your September '90 issue and, as always, it was excellent. It had an article on Joel Johnson, and I'd like to know if you're going to do more articles of this type. It's a great idea, because it gives us a chance to get to know these guys better! If you're going to interview other people, could you interview Masami Hirosaka?

SAM KWAN
Monterey Park, CA

Sam, I'll be doing a series of interviews with many of the top racers, but to inter-

view Masami, we would need an interpreter—but we're working on it! CC

RACCOON RACE CLUB

I'm the president of a new R/C car club. The unique thing about our club is that all of the members are inmates in the North Dakota State Penitentiary. We've just received permission to purchase and run our own cars. We could, however, use some assistance in obtaining information on the various cars, the tracks they run on and the different classes of racing events.

I'd like to receive any back issues of your magazine that you could donate to the club to get us started, and I'd like to know if you could send any other infor-

mation that would be helpful to us. I'd also like to subscribe to your magazine. Could you let me know how much a yearly subscription is, and start mine right away?

DUSTY L. NELSON
Bismarck, ND

Dusty, I'll put some old stuff together and send it to you! (Subscription cards are in the mags.) Bismarck, ND—isn't that where the International Order of Raccoons' official burial site is located? CC

COUGARS? CATS?

In your May '90 issue, there was an article about Top Cat mods, and it said that

Compromise No More

MAXIMUM DYNAMIC RANGE

Astro's New Model 205 Hi-Rate Electronic Speed Control has the largest dynamic range available anywhere. It works with 6 cells to 32 cells...efficiently. It works with 50 Watt Ferrite 05 motors and 2000 Watt Cobalt 60 FAI motors.

100 AMPS PULLING POWER

Five IRF-Z40 MOSFETS, a special gate drive circuit, and a Built in Aluminum heat sink give the 205 a peak (1ms) rating of 700 Amps and a 30 second rating of 100 Amps. Power enough to handle twin 40 motors sucking 100 amps during monster truck pulls.

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Four IRF-Z30 MOSFETS in the brake circuit have a peak rating of 500 Amps and a 5 second rating of 100 Amps. Powerful enough to stop an 80 mph dragster or a 400 lb sled. And the regenerative braking circuit pumps amps back into your nicads during braking.

OPTO-COUPLING

Opto-coupling eliminates any direct connection between the radio circuit and the motor

circuit.

Motor noise can't get into your radio receiver and cause glitching.

HI-FREQUENCY SWITCHING

Hi-Frequency switching is much more efficient than frame rate switching,

especially at lower throttle settings. Motor heating is greatly reduced, motor runs noticeably longer, and throttle response is extremely fast.

SIGNAL FILTERING

A special triple pole low pass filter in the decoder circuit produces a SOFT START and a very smooth and precise speed command. Try it once and you will never want to return to the spastic control you live with now.

16 AMP SHOTKY DIODE

This massive flyback diode greatly reduces switching losses during partial throttle operation. The control runs much cooler and more efficiently and your nicads run longer.

NO MORE COMPROMISES

I designed the Astro Model 205 Hi-Rate Speed Control with No Compromises. I gave it all the features that serious electric competitors have been asking for. I hope you like it.

Bob Boucher
Bob Boucher



AstroFlight INC.

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the Schumacher World Team drivers use all those parts in their cars. Do they use Top Cats, or Cougars, or a combination of both?

Also, do you know where I'd be without *Car Action*? I'd probably be drooling over someone else's trophy instead of my own! Thanks!

CHRIS MOE
Spokane, WA

Chris, some of the team drivers run with graphite chassis and some don't, but their Cougars are mostly stock. Keep the droolers away from your trophies! CC

"IN-QUIZATIVE" CHRIS

- Can I put a Trackmaster belt-drive transmission and a Hyperdrive transmission on the RC10?
- Is there a steel gear set for the Royal Crusher?
- When can we expect a "Track Report" and/or a shootout between USA-1 and the Clod?
- What type of chassis does the Schumacher Cougar have?
- Could we see a 4WD shootout between the Kyosho Lazer and the Yokomo YZ-10?
- I've heard rumors that the next World Championship will be held in the U.S. Are these rumors true and, if so, where will it be held?

Tell Chris Chianelli that I love his hair!
CHRIS ROSE
Salina, KS

OK, Chris, are you ready?

a) Yes, and at the same time, too!

b) No.

c) Soon!

d) Aluminum

e) We could, and probably will in the near future.

f) Detroit, MI

Thanks, maybe I won't cut it all off!

CC

(Continued on page 18)

POWER MONSTER

Power is the only thing Monster trucks understand. Team Astro speaks their language. Ten super power cobalt magnets, a skewed seven slot nature, twelve turns of 22 gauge wire, an oversize commutator, oversize brushes, and justable timing.

They all spell FULL PULL POWER.

CORDS ARE FALLING

Team Astro Pullmaster motors are powering monster trucks to new records at NARCTPA truck pulls all over the midwest. The reasons are many but they all boil down to one thing...the Team Astro Pullmaster Cobalt Motor delivers a full pull every time.



NO NEED TO BE LEFT BEHIND

See your favorite hobby dealer TODAY and ask for the Team Astro Pullmaster Cobalt motor.

◆◆◆◆◆ FLASH! ◆◆◆◆◆

World Records at NARCTPA

World Championships

On October 14th & 15th
TWO WORLD RECORDS were set
using Team Astro PULLMASTER motors

2WD Open I: 203 lbs.

1ST PLACE: Charles Allen

2WD Open II 350 lbs.

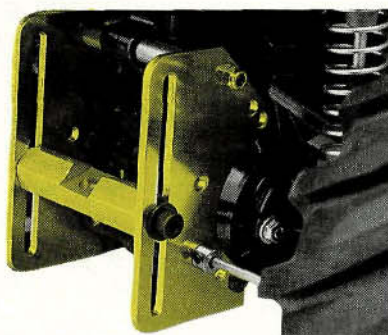
1ST PLACE: Gary Kmit -

**FULL PULL
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The Newest Way To Get Hitched

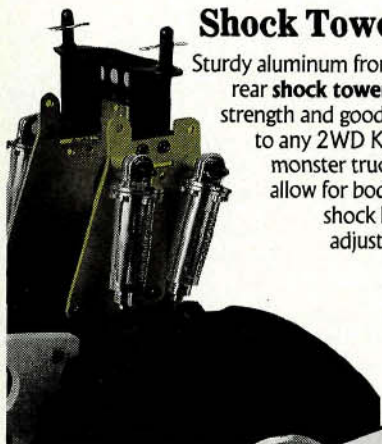
MaxTrax heavy-duty aluminum hitches assemble easily. Instructions and all mounting hardware are included.



- Strong aluminum construction with gold-anodized finish
- 2½" of drawbar height adjustment to meet track conditions
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- Little or no modification to vehicle required
- MaxTrax makes hitches to fit most popular R/C monster trucks

Shock Towers

Sturdy aluminum front and rear shock towers add strength and good looks to any 2WD Kyosho monster truck and allow for body and shock height adjustment.



See your local hobby dealer for entire MaxTrax line.



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PUBLISHER'S PAGE

by LOUIS DeFRANCESCO, JR.



Gary McAllister, Publisher Louis DeFrancesco, Cristy Mitchell and MC Dan Moynihan pose for the camera at Thunderdrome—the R/C event of the year. Watch for full race coverage next month!

PETER DIAMANDIS of DCI Communications, one of the largest special-interest publishers in the country (*Road & Track*, *ELLE*, *American Photographer*, *Cycle World*, etc.), clearly defined what the editorial objective of a special-interest magazine should be: "...[to] reinvent the wheel every month to excite and delight the reader."

In essence, Peter is telling us that, if a magazine can constantly inform and entertain its readers and continually captivate their attention and imagination, then the publisher, editors and the rest of the staff have done their job. Every month, we strive to bring you a diverse, yet well-balanced, cross-section of articles and features in *Car Action*. There are no elitist attitudes in this building!—the hobby has many facets, and we try to cover them all.

We took a different course with this issue and included some longer features on shocks, wheels and manufacturers' catalogues. It wasn't our intention to compare the products of competing manufacturers, but to show you, the R/C consumer, what's available in what price range so that you can make intelligent buying decisions.

As for the catalogues, many are available from R/C manufacturers for a few dollars, or even free. It isn't economically feasible for most manufacturers to showcase their entire product line each month in R/C magazines, but sending away for one of the catalogues affords you an opportunity to see what they offer.

NO POLITICS

Whenever a racing organization sets forth rules and regulations, there are differences of opinion and sometimes ensuing controversy. With great disillusionment, I have been watching a battle that's taking place between ROAR and a few manufacturers. I honestly believe the names of the parties involved are irrelevant because this is a war of "egos" and not principles. Unfortunately, a "urinary olympiad" like this is destructive to our great hobby. I've even been privy to some of the correspondence, and it's demonstrative of only one thing—a stammering inability to communicate as intelligent adults. I urge the people involved to reconsider their positions and get on with more positive endeavors that will benefit us all.

The details of this mess have been printed in the pages of the smaller newsletter rags, but it's *Car Action's* strictest policy not to report on these unproductive political issues, but only on those that are positive and will perpetuate the R/C hobby.

READERS' RIDES

Welcome to Readers' Rides. This is our way of giving recognition to the unique, innovative—and sometimes bizarre!—vehicles that our readers have created. If you want to join the growing ranks of Readers' Rides winners, send us a sharp, uncluttered, well-exposed color photo (no Polaroids, please!) of your car or truck, along with a brief description. Who knows? The Ayatollah of Radio Controlla might pick your car.

If your ride is chosen, you'll receive a one-year subscription to *Car Action*, or we'll extend your existing one. You'll also be eligible for the third annual "Readers' Ride Car of the Year Contest" in the fall of 1991. Send your photos to Readers' Rides, *R/C Car Action Magazine*, 251 Danbury Rd., Wilton, CT 06897. Be sure to include your address and phone number, in case we need to contact you!

WASTELAND WARRIOR

This is probably the most wild, bizarre and cool reader's ride that we've ever seen! Robert Haverfield of Denver, CO, is responsible for this custom-built replica of a vehicle that was used in the movie "Damnation Alley." This car is loaded with small features: working headlights, interior lights, and instruments, along with a rocket launcher complete with elevation and axis control. Although it doesn't have a suspension, it has three wheels on each axle that easily roll over any obstacles. It takes a 7-channel radio to manage all the functions! You'll definitely see more of Robert's vehicle in the pages of *Car Action*—soon!



IS EIGHT ENOUGH?

I can imagine the look on the derk's face when Kirk DeFord (of Port Gamble, WA) walked into the hobby shop and ordered eight pairs of DuraTrax shocks. What would you need that many for?! How about a Super Clod Buster with a scratch-built frame, a set of Trinity's hottest Clod motors (with power from 12 cells) and a Turbo Zeta operated by a Futaba PCM radio? Even with the extra weight, this Clod can spin all eight(!) of its wheels. It performs exceptionally, and, with the custom-bent copper headers and a full assortment of lights, it's the stuff that nightmares are made of!



3...2...1...LIFTOFF!

Check this out, all you custom model builders! Here's a working rocket with a fully radio-controlled trailer built by Adam Patterson of Altadena, CA. The trailer is pulled by a Kyosho Blizzard that's been modified with large 540 motors (as opposed to 380s) and a working, servo-operated fifth wheel (trailer hitch). The trailer is operated by a 2-channel radio, while the Blizzard is controlled by a 4-channel radio. The trailer's features include a working suspension, a set of lowering legs (so it doesn't fall over when the Blizzard is removed), and a launching rail that can be raised and lowered using the transmitter. The trailer has a safety switch so the rocket can't be launched until it's in a vertical position. Adam sent lots of photos (and a videotape!) of other projects that he's completed, and they're incredible!



BURNIN' DOWN THE CLOD

We receive pictures of Clod Busters every day, but Paul Trevino's (of Cheyenne, WY) is one of the nicest! Many hours of hard work and lots of home-made parts went into this brutal beast. There are so many hop-ups that it would take a whole page to list them. Designed for pulling, this Clod weighs an incredible 27 pounds, and it's definitely one mean machine!



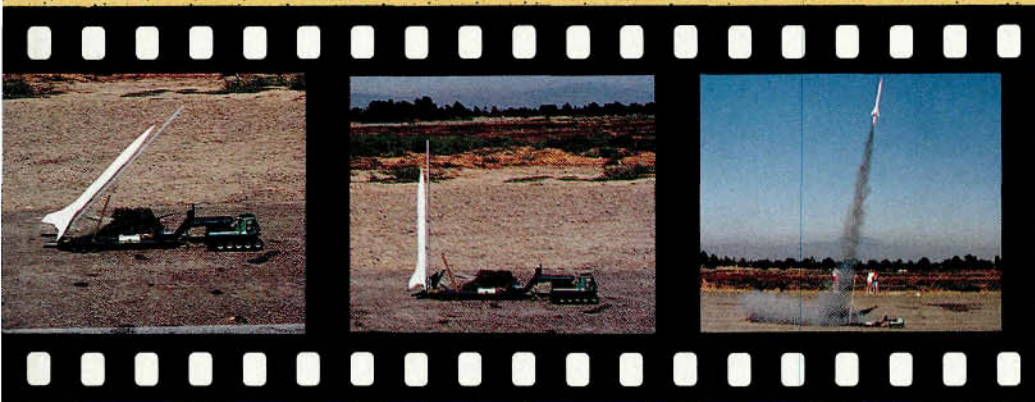
Q-CAR

This hyper hybrid was originally a TRC Pra-10, but when Tom Knuth of Green Bay, WI, was finished, it was more than stock! He replaced the front suspension with a 10L front end, and his wild motor is a combination of a Trinity armature and a Technigold can. To control this monster, Tom uses a Futaba PCM radio with a Tekin Pro XT ESC. The nicely finished Bolink NDRA Firebird wedge hides his modifications from the competition.



OPTIMA MID CUSTOM CUSTOM!

Talk about dedication—Rogelio C. Abad has to make a 2 1/2-hour trip from his hometown in Quezon City, Philippines, just to buy this magazine! Pictured is his son's Optima Mid Custom that features ball bearings, Option House Platinum rear shocks, a Uni-Crank steering and servo-saver set, a Futaba Mega Tech Junior 2PBK with an MC 112B ESC...and the list goes on. With more mods in the works, we'll be surprised if there are any original parts left on the car!

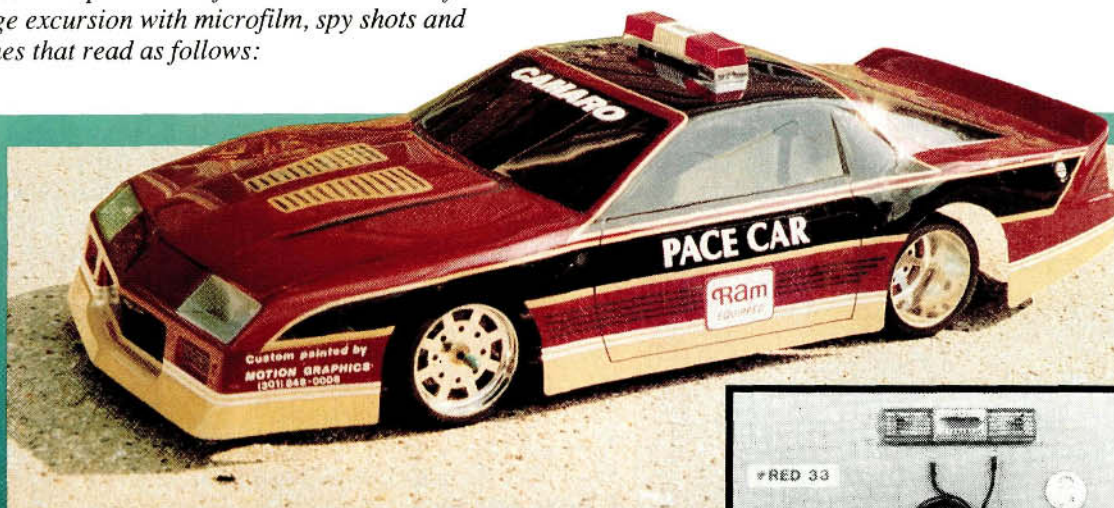


INSIDE SCOOP



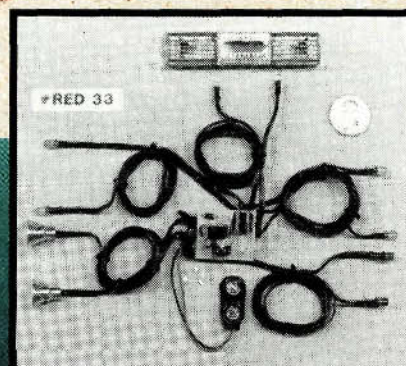
by CHRIS CHIANELLI

As directed by the Ayatollah of Radio Controlla, Commander Crash Chianelli reporting back to the faithful followers of the Grand High Exalted with pertinent information! I'm back from my latest espionage excursion with microfilm, spy shots and stolen communiques that read as follows:



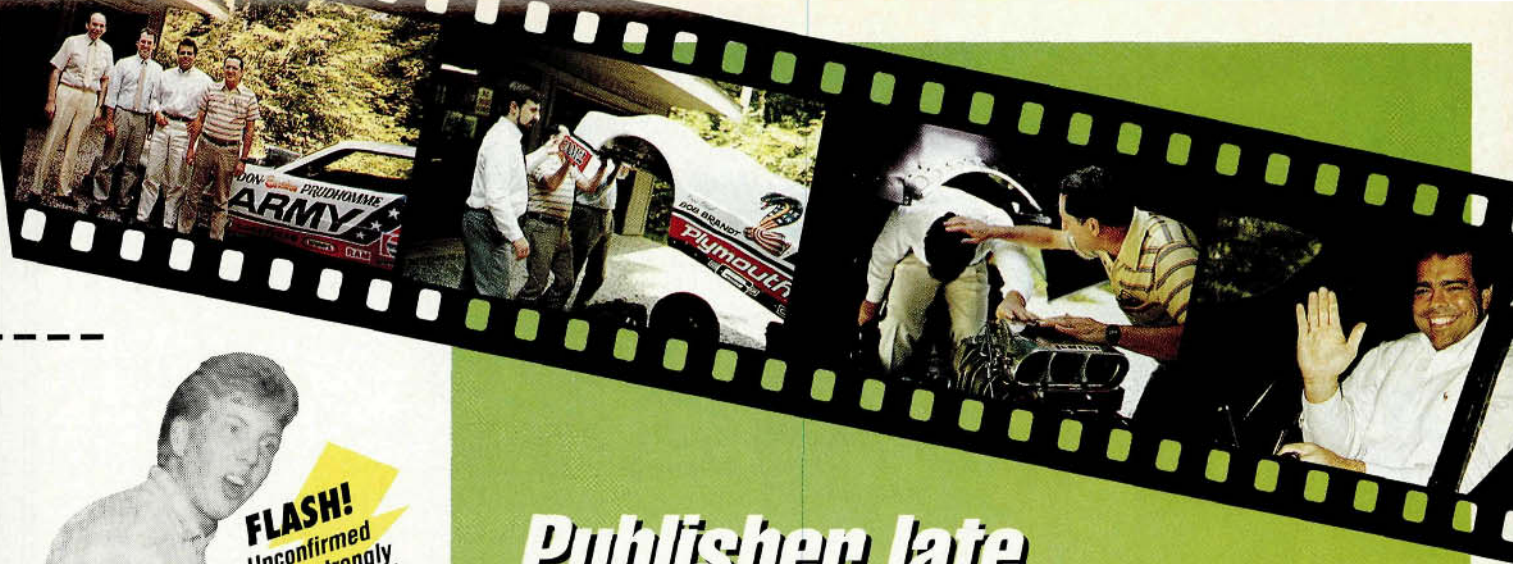
● PACE CAR LIGHTS

Those of you who have always wanted to start local races with your own 1/10-scale pace car (I'm sure there are many of you out there), can now buy lights that flash. RAm offers a package that includes headlights, taillights and a flashing light bar that has an adjustable rate. It runs on a 9V battery or directly off a 6- or 7-cell Ni-Cd pack. All club presidents and track operators are invited to order one directly from RAm at *half price!*



PRO SOLO BARTOS

Good-natured Buddy Bartos, who's well-known for his 1/12- and 1/10-scale road and superspeedway racing record, has taken up a new hobby—full-scale racing! Although he's well-liked on the full-scale scene, he almost ruined his reputation when he had a run-in with SCCA (Sports Car Club of America) officials. Buddy allegedly became very indignant when he was told to remove the 10 Bud's Racing Products 1/10-scale wings from his GTI!



FLASH!
Unconfirmed reports strongly suggest that Chris will be racing for the Trinity team in the near future.

Publisher late... Parma solution

Last summer, our Group Publisher, Louis DeFrancesco Jr., and Advertising/Sales Director Jason Stein visited Parma International. Because of a late date the night before (allegedly with Miss Brigitte Peugeot—I'm jealous!), the next morning, Louis was running late for his 8 o'clock flight home. Shown in frame one from the left are Gerry Goldberg, Mike MacDowell, our leader, and Parma owner Ken MacDowell. In unison, the Parma boys told Louis, "Here Louis; to save time, take our Parma Plymouth funny car to the airport." Frame two: Ken and son

Mike try, but fail, to lift the body so that Louis may enter. Enter Jason Stein to save the day with a two-fingered lift (while displaying his incredible athletic profile). Frame three: while entering the funny car, Father MacDowell blesses Louis with holy water, and Louis bravely waves farewell. (Actually, he had forgotten how fast a funny car can go, because his head was filled with memories of the enchanting Ms. Peugeot.) Macho-man Stein was last seen racing to the estate of that heart-breaking redhead, Brigitte I-Love-Salesmen Peugeot!

DOSEK

At the 1/12-scale World Championships in Singapore last August, Chris Dosek not only TQ'd and took 1st place, but, to his surprise, he also won top honors in Concours!

DOOD-IT



DARING DAHM



When it comes to his designs, Ira Dahm of Dahm's Racing Bodies, has never been accused of playing it safe. Although Dahm's does produce scale bodies (e.g., the Fiero GTP and others that will be available soon), the com-

pany is known more for its design departures, like the new '91 Chevy S-10 and the Custom Dodge Dakota with supercharger. Dahm's bodies are controversial, but that's healthy. Some of the bodies are for rebel racers who don't let

others tell them what they're supposed to like. That kind of behavior is strictly for wimps who can often be overheard saying, "Oh...ah...OK...yeah, yeah, you're right; I guess I *do* like blue better than red. Thanks for reminding me."

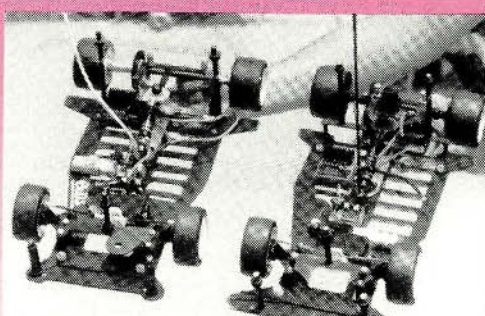
Franco-Roman Rally



The Strike 4WD from the Italian Trading Co. is a new, 1/8-scale, ready-to-run Peugeot Rally car that features a pull-start .21, a transverse double-branch suspension, a pressure-fed fuel system and—get this!—reverse! (assuming that our Italian translator is correct). At the moment, that's all we know about this one.



Here's the original Associated 10L compared with the newer, narrow, oval version. The new chassis, which is 1 3/4

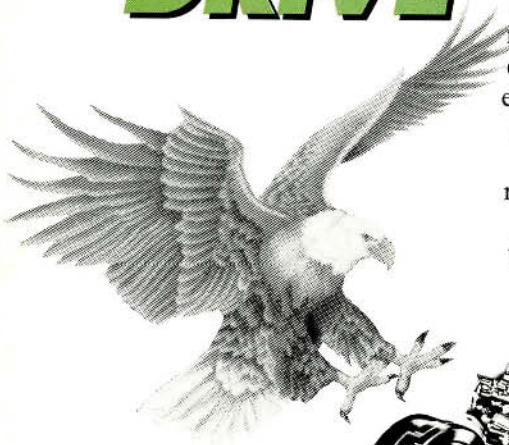


inches narrower than the original, has a body that's much closer to scale than the over-wide types that we're

used to. Because of its lower front drag, the car is faster on high-speed ovals.

THIN IS IN

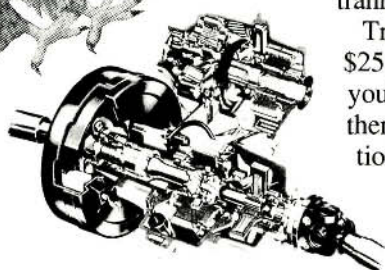
EAGLE DRIVE



Traxxas will be fitting all of its Eagles with a new transmission (as yet unnamed) that's a production version of the prototype that

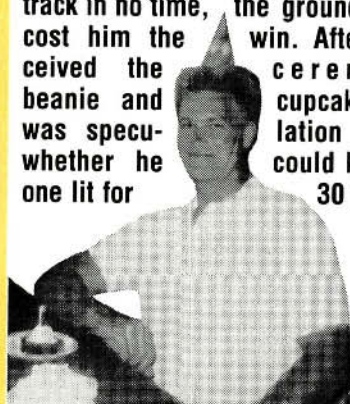
Tom Owens runs in his Nats-winning TRX-T. The new transmission has an adjustable slipper clutch; a 2.72 gear reduction that eliminates the need for tiny, inefficient pinions; special gear material that allows the tranny to run as quietly as a belt drive; and gears that are all 48 pitch. The tranny will be standard on future Eagles, but owners of the older versions can buy the new tranny directly from

Traxxas for about \$25. To be eligible, you'll have to send them your registration card and your old tranny.



JOEL'S SURPRISE PRIZE

During the awards ceremonies at the Kyosho 1/8-scale World Challenge in Champaign, IL, Joel "Magic" Johnson received the Most-Fabulous-Flameout Award after his near-win. After leading the A-Main, Joel committed the cardinal sin of 1/8-scale racing: he flipped his car on a fuel lap. His car quickly flamed out, and although he was back on the track in no time, the ground he lost cost him the win. After he received the ceremonial cupcake, there was speculation as to whether he could keep this one lit for 30 minutes.



I'll see you next time—or sooner, if I catch you in my spyglass! CC

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LETTERS

(Continued from page 9)

PROJECT HOLLOW-POINT

I own a Traxxas Bullet, and I think it's great. When are the hop-up parts coming out? Could I use pinion gears made for the RC10 on the Bullet? How come Team Traxxas never has anyone enter the Nationals? I think that the TRX-T Eagle has an excellent chance of winning. Your mag is the best!

JEFF WOLFORD
Charlottesville, VA

Jeff, the Radicator has replaced the Bullet, but if there's enough of you out there who would like to see a Project "Hollow-Point," let me know, and I'll set it up!

CC

A PLEASED RACER

I've been racing R/C cars for about three years and, for the past two, I've been a member of ROAR and SEMROCC. I've raced at different tracks, but I always enjoy racing at SEMROCC events the most.

In July, I participated in the Trinity Sportsman's Cup race. This was the greatest racing experience I've ever had! The Sportsman's Cup series gives people like me a chance to gain experience from the Invitational drivers and have the excitement of racing in a major event. I hope that Trinity and ROAR can keep this series going and expanding in the years to come!

I'd like to thank everyone who's involved in the Sportsman Cup series. I think that you're all doing a great job! Keep up the good work!

THEODORE T. BAKER
Ypsilanti, MI

YEA!

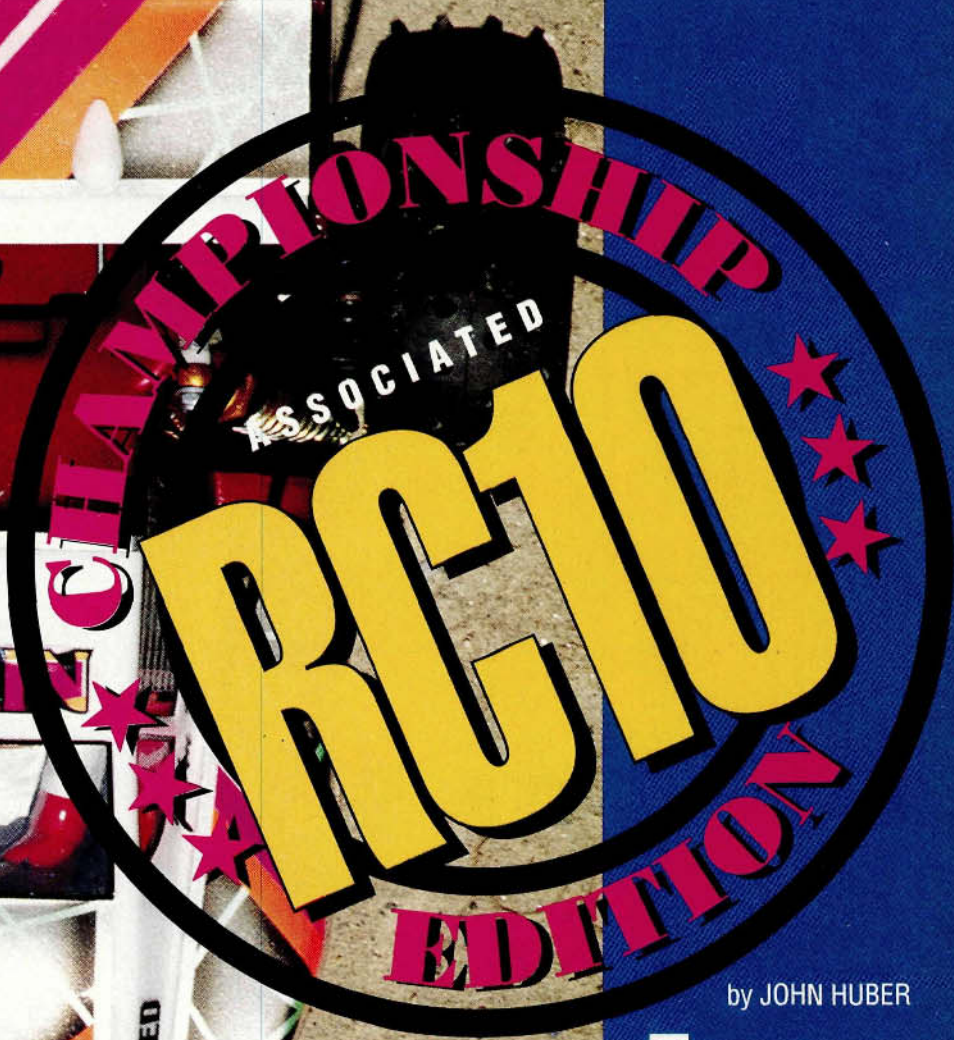
CC

A LITTLE VARIETY— A LOT OF SPICE

I've been reading your magazine for about four years, and have been subscribing for two. I enjoy it and have stopped buying the other two R/C car magazines!

I thought I'd let you know what's happening in our part of the country! In southern New Jersey, we have a little club called the "Asphalt Oval Racers." We run on a converted tennis court that's a flat

(Continued on page 26)



by JOHN HUBER

THE RC10 WAS introduced six years ago, and it's still one of the most competitive cars on the market. This year, Associated* redesigned many of the parts and created the Championship Edition. No, this isn't another graphite chassis version, but you don't need one to make the RC10 a winner. Cliff Lett just won the ROAR

Causin' hurtin' fer certain



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H



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“To improve the rear traction and the car’s tracking, the hub carriers have been redesigned...”

Off-Road Nats with an aluminum chassis, and many other Associated drivers still use them, too. The Championship version will be the one to watch in the '90s.

THE KIT

The front A-arms, in-line axles and shock towers are the same as those on the

graphite version, but to increase suspension travel, .71-inch front shocks are also included. (Although these shocks have been available for quite a while, this is the first time that they’ve been included in a kit.) New bulkhead and hub carriers have been added to improve suspension geometry. To keep camber more consistent throughout the suspension travel, the

rear upper link is mounted to the bulkhead 1/2 inch in-board of the old location. To improve the rear traction and the car’s tracking, the hub carriers have been redesigned to increase rear toe-in to 3 degrees. The rear arm mounts have also been moved forward so that the dogbones line up better with the tranny.

The black idler gears and the new gear cover allow



"The only things this kit didn't have were paint, a radio and a battery."

trol that I need to survive in competition.) The only things this kit didn't have were paint, a radio and a battery.

Rather than go over the assembly process, which is similar to that of the original RC10, I'll describe how the car is set up and how it performed. (The October '90 issue has an article on the RC10 Graphite that covers the tranny set-up.)

To a large extent, shock absorbers will determine how your car handles, and to work consistently, the shock-absorber chamber must be free of air. Once you've filled the shocks with oil, move the shaft up and down several times to free air bubbles that get

for quick diff adjustments. Turnbuckles and three-piece wheels are also included. (See the article entitled "Associated Three-Piece Rims" in the September '90 issue.) I was disappointed with the mechanical speed controller that came with the kit—this was supposed to be the competition version. (For the last few years, I've used nothing but electronic speed controllers because they have the throttle con-

trapped below the shock piston. Top off the shock and install a CRP* pressure gasket. (This gasket is the only piece that isn't included with the kit.) When the shock shaft enters the chamber, it displaces oil. If no provision is made to accommodate the oil, the increased pressure forces it to leak from the seals. The pressure gaskets allow an air pocket to remain in the shock to compensate for this displacement, but they

keep it separate from the oil. I used 20WT in the front end and 30WT in the rear, and I chose gold springs because they've worked well on my other RC10. I set the springs so that the arms were even with the chassis.

Recently, I bought a new speed controller for my old RC10. I've been doing a lot of off-roading, but I was having trouble making time. I already had two strikes against me: my SCR batteries were two years old, and I was running in the Modified Class. The new Tekin* 411p has a regenerative circuit designed

trusty Futaba* PCM. I've had it for a year, and I've never had interference problems. I like strong servos with plenty of torque and, because I've used the Futaba S130 in my other RC10, I know that it performs well. Some people like a lightning-fast 132 SH, but I don't think it will survive the kind of abuse that I intend for my cars. I'd much rather sacrifice the speed and size of the 132 for the reliability of the 130.

TEST THRASHING

At the local track, Dr. Pond grabbed the controller and let the car go wild. We were

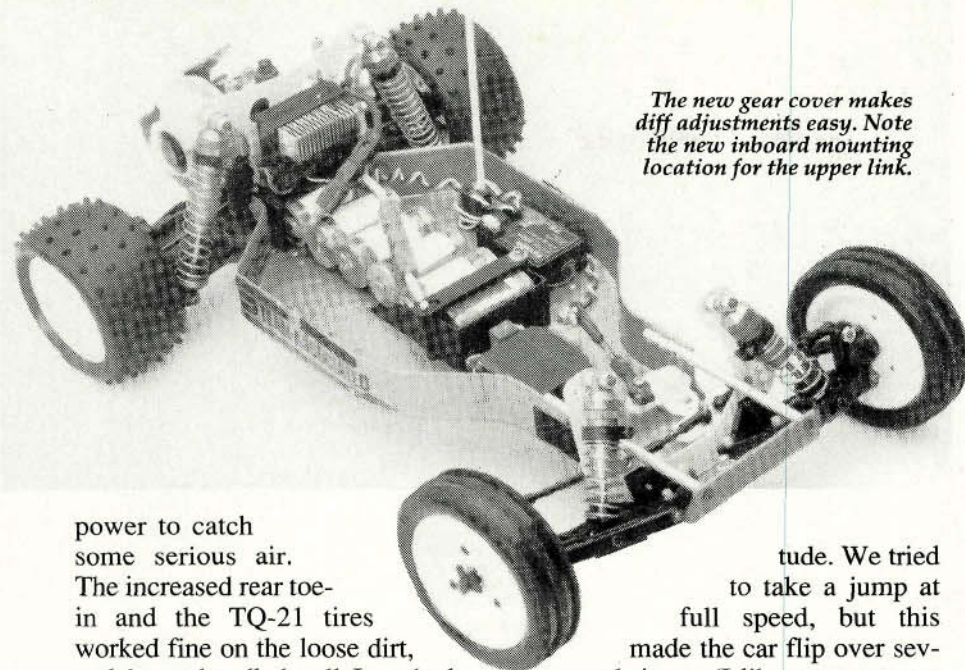


To mount the body on the chassis, you only need a couple of small pieces of hook-and-loop tape. Very little dirt managed to get past it, because it fits the chassis so well. Thanks to Curtis Hustings for the killer paint job.

to increase run time, and this has enabled me to go up another tooth and still make time!

For the radio, I chose my

both impressed by the speed of the stock motor. Although it wasn't a land missile, it did have enough



The new gear cover makes diff adjustments easy. Note the new inboard mounting location for the upper link.

power to catch some serious air. The increased rear toe-in and the TQ-21 tires worked fine on the loose dirt, and the car handled well. It pushed a little with the ribbed front tires, but I like my cars to have some understeer.

The car was very level off the jumps, but on some, we had to use the throttle to achieve a proper atti-

tude. We tried to take a jump at full speed, but this made the car flip over several times. (I like to come at a jump at full speed, but it doesn't always work.) We kept the nose up and the flight level by letting off the throttle about 5 feet away and punching it as the car approached the jump. The suspension worked well (as I

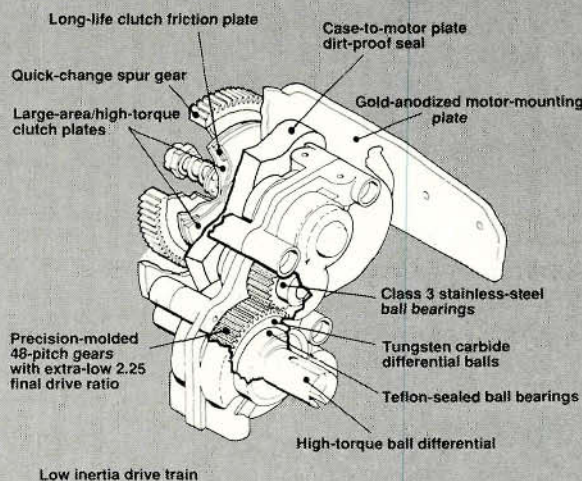
THE STEALTH

Several after-market transmissions for the RC10 are available from various manufacturers: belt drive, chain drive, gear drive, ball diff, gear diff—you name it, they have it. The RC10 stock gearbox hasn't changed much in six years, but you have to work on it to make it really efficient. Now, Associated has its own after-market tranny—the Stealth. First seen at the 1990 World Championships in Australia, it has been used successfully by team drivers in other races.

Unlike the stock tranny, the Stealth has a ball diff inside the gearbox, and it uses tungsten carbide $\frac{1}{8}$ -inch balls, which hold up well in off-road cars. The molded 48-pitch gears are light and run smoothly. The three gears in the Stealth tranny have considerably less drag than the six 32-pitch gears in the stock version, and the gear ratio is an extra low 2.25:1. For optimum efficiency, six Class 3 stainless-steel ball bearings are included. To keep out dirt, the differential is sealed inside the gearbox and supported by two Teflon-sealed bearings.

To improve traction, Associated has developed a slipper clutch. The Associated Torque Control (ATC) system uses durable friction plates with large-area/high-torque clutch plates. Another nice feature is the quick-change spur gear, which makes gear changes easier at the track. To help keep dirt out of the gear teeth, a case-to-motor plate seal is included. Because there's a slight difference in the tranny's mounting screws, a steel template is also included so that new holes can be drilled. (In the future, all chassis will have the holes pre-drilled.)

I was very impressed with the pre-production model. By the time you read this, the Stealth will be available. Check it out!



ASSOCIATED RC10 CHAMPIONSHIP

Type Off-road
Scale 1/10
Sug. Retail Price \$290

DIMENSIONS:

Overall Length 15 inches
Width 9 inches
Wheelbase 10.5 inches
Front Track 8.5 inches
Rear Track 8 inches

WEIGHT:

Gross (w/bat.) 56 ounces

BODY:

Type Protech 2 buggy
Material Polycarbonate

CHASSIS:

Type Tub
Material Aluminium

DRIVE TRAIN:

Primary Pinion/spur
Transmission Gear
Differential(s) Ball
Bearings/Bushings Ball bearings

SUSPENSION:

Type (f/r) Lower A-arm,
upper control link
Dampening (f/r) Oil-filled,
coil-over shocks

WHEELS:

Front: Type Three-piece nylon
Dimensions (DxW) 2.1 x .625
inches
Rear: Type Three-piece nylon
Dimensions (DxW) 2.1 x 1.25
inches

TIRES:

Front Rubber ribbed
Rear Rubber cut spikes

ELECTRICS:

Motor Associated stock 05
Battery 6- or 7-cell stick pack*
Speed Controller Mechanical wiper
type

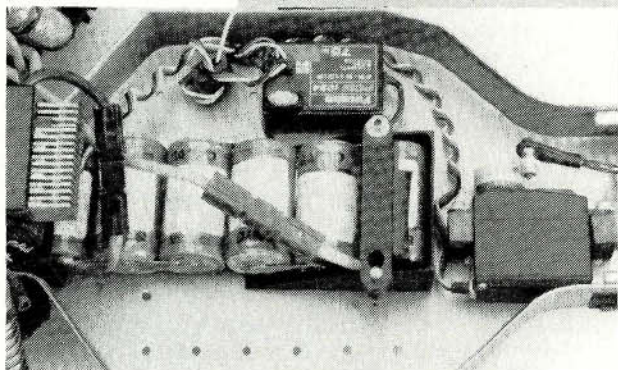
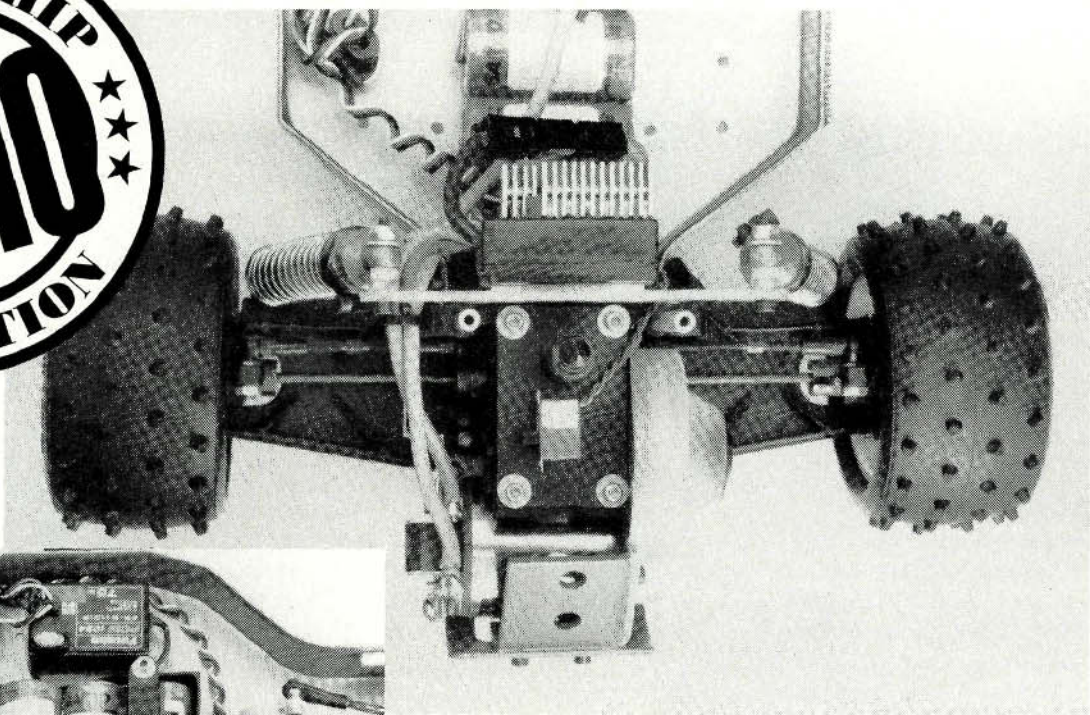
OPTIONS AS TESTED:

Tekin 411P electronic speed controller; 6-cell Sanyo SCR pack; Futaba Magnum PCM radio; CRP pressure gaskets for the shocks.

COMMENTS:

I've driven the RC10 for years, so I knew what to expect. I forgot, however, how well the tub chassis keeps out dirt. The body fit tightly around the sides, so only a small amount of Velcro was needed to hold it in place. The new items in the kit make the car handle much better than the original version. Although it's a little overweight, it still performs well. The new dust cover—a welcome addition—made differential adjustments much easier.

* not included



■ Above right: It doesn't take a trained eye to see the increased rear toe-in. The alignment of the dogbones with the gearbox has been improved by moving the arms forward.

■ Above left: The tub chassis has a lot of room for radio gear. The ball connector on the battery holder makes pack removal a snap.

■ Below right: Turnbuckles make track-side tuning easy. The insides of the rims are smooth, and they won't collect dirt.

■ Below left: The new gear cover makes diff adjustments easy. Note the new in-board mounting location for the upper link.

had expected), and it kept the car stable on bumpy turns.

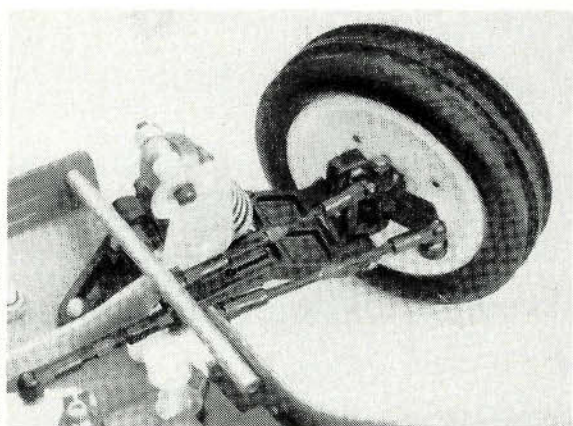
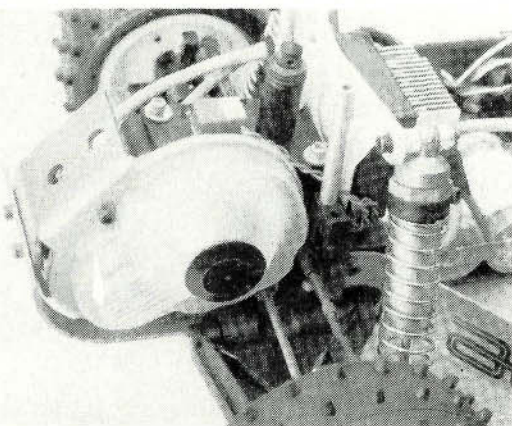
Luckily, I had no major mishaps. I did notice a slight leak in one of the shocks, but that's because I hadn't tightened the cap properly. After you've built the shocks, clean them thoroughly with motor spray so that leaks will be easy to see.

Even though the tires seemed tight, I noticed that after a few sideways shots into the boards, one of them started to come off the rim. Because the screws that hold the rims together thread into nylon, there's a limit to how much they can be cranked. A tiny 4/40 nut used on

slightly longer screws should provide all the strength necessary to make them tight.

I've modified my other RC10 so much that I can hardly call it an RC10! I was amused that after all that time and money, the Championship version handles just as well. I'll install a modified motor to see if I can be competitive at the local track. I can taste victory already!

**Here are the addresses of the companies mentioned in this article:*
Associated Electronics, 3585 Cadillac Ave., Marina Del Rey, CA 90292.
Custom Racing Products (CRP), 8784 Plata Lane, Atascadero, CA 93422.
Tekin Electronics, 970 Calle Negocio, San Clemente, CA 92672.
Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718. ■

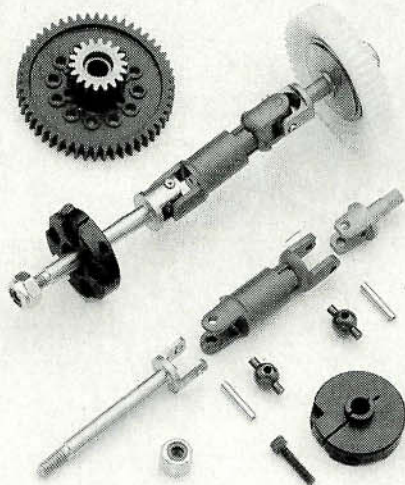


NEW FROM THORP

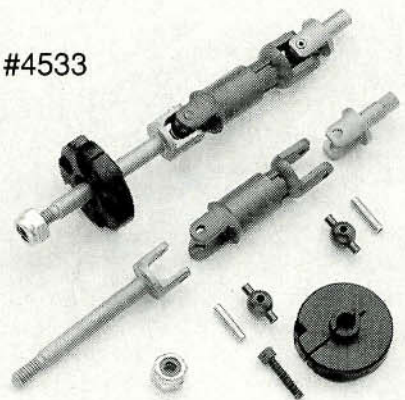
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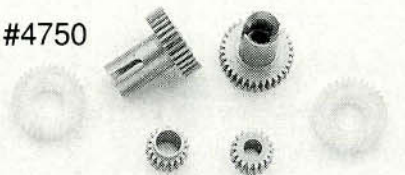


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LETTERS

(Continued from page 18)

asphalt track, approximately 125 feet long. We run suspension class only (95 percent of the cars are RC10s) and provide handout motors (Parma Super Stock) for a nominal cost. We allow six cells and any body style. This helps to keep the cost down and makes it easier to be competitive. We have about 30 racers and sponsor three series with trophies at the end of each.

Please continue producing your excellent magazine! Your technical articles and your new-product tests are appreciated. The coverage you provide on major events is good, and your question-and-answer columns are well-done!

I have one small complaint concerning your coverage of boats and other non-car subjects. Please stick with R/C cars.

BLAIR L. GOLTRA
Somers Point, NJ

Blair, thanks for the compliments! We receive many letters from people who are interested in all types of R/C vehicles, and they request an occasional article on boats or planes. It's an enjoyable change of pace, and we don't do it very often. We try to please everyone.

CC

THE HOT SQUEEZE

Two months ago, I purchased a Stinger MKII and, after two days of building it and trying to start it, it finally worked. Now I have a problem—after using a half a tank of gas, my fuel-line connector on the engine gets so hot that when the gas reaches it, all the alcohol boils away. I didn't have this problem when I first ran the car, but it seems to get worse with every run.

Another problem is with the glow plug. After four or five tanks of gas, I have to replace it. I've tried cleaning it with motor cleaner, WD-40, gasoline, R/C gas, engine de-greaser—nothing works! Are these two problems related? Help!!

DAN ROHATS
Delray Beach, FL

Yeah, the problems are probably related,

Dan. Between the heat (that's most likely causing the motor to shut down) and the blown glow-plugs, you're leaning-out the mixture too much. Although the 2-stroke glow engine is air-cooled, the fuel also carries away much of the heat, particularly during the brake-in stage, which is where I think that your problems began. Next time you try to run the engine (if you didn't ruin it with a hot run) don't screw in the needle valve so much that you squeeze all the rpm out of the engine. Back off a half to a whole turn to make a richer mixture. This allows more un-burned fuel to come out of the exhaust and carry away the heat. Your motor won't last long with screaming-hot runs, but if you adjust the needle with a couple of hundred fewer rpm, your motor will have a longer, more reliable life.

CC

TO SPOIL, OR NOT TO SPOIL THE FUN

I'm responding to Rob Pegler's letter in the October '90 issue but, first, I'd like to make it clear that I'm not trying to put anyone down!

I'm the proud, happy owner of several Blackfoots, and my dad owns one, too. I don't consider my Blackfoot to be superior to any of the "monster trucks"! My idea of a monster truck is the JR-XT and other conversions that use modified motors and 7-cell batteries. My Blackfoot uses a stock motor and a 6-cell battery.

I don't think it's fair to say that Blackfoots can't be competitive. As an "off-roader," Mr. Pegler should support these "fun" trucks and their owners and consider them fellow off-roaders! Although Mr. Pegler stated that these trucks are, "...simply not as good as today's technology," they should have the chance to compete fairly! He said that making a new class wouldn't be any use to him. What about other people? He said he wasn't a "fun spoiler"—he should practice what he preaches and let others have fun and win some races too!

CHAD HARDY
Decatur, IL

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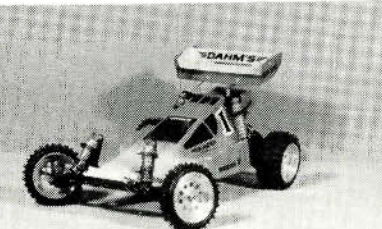
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I've followed the "truck controversy" since it started, and I thought it was time to add more fuel to the fire!

I've raced in the monster truck class for over a year, and I've raced both the "out-of-date, play-type" and the race trucks. Possibly to the dismay of Mr. Pegler and Mr. O'Mea, I've won A-Mains with *both* types of trucks! That's right—it's possible to beat the conversion and fully fledged racing vehicles with a "plaything." (In case you're wondering, the rest of the field *didn't* fall out of the race, leaving me to finish alone.)

I don't understand why people are against forming a separate class in which to race the "production trucks." Actually, the production trucks should be kept in the same class, and a new class should be formed for the conversion trucks! This new class could be called, "Stadium Trucks," rather than the generic, catch-all "Monster Trucks." I thought that the R/C trucks were supposed to emulate full-scale trucks. If that's the case, the new conversion and race trucks emulate full-scale stadium race trucks more than they do monster trucks!

Keep Blackfoots, Big Bears, Mud Blasters, etc., in the monster truck class because they resemble (in terms of suspension, motor and other modifications) full-scale production vehicles. These trucks weren't designed for racing, but they're not "junk" or "out-of-date"! They just belong in a different category. To borrow Mr. Pegler's idea, you don't see stock cars and Indy cars race on the same track on ESPN, do you?

I was appalled at Mr. Pegler's statement that, "...creating another class for us off-roaders to deal with isn't worthwhile. We spend enough time at the track already." I can't believe that true R/C enthusiasts would be worrying about how much time they spend at the track, rather than promoting the sport by establishing a new class. Younger drivers should have a chance to gain knowledge and experience while competing at their own level! After all, they're the future of R/C—without them, R/C has no future!

I'd welcome the introduction of separate classes for different trucks, and I'd race in both! Winning is great, but so is running in a close, competitive race where you have to fight to the finish. That just doesn't happen in the truck class as it stands.

EDWARD T. MELOSH
Grand Blanc, MI

Well, there are two opinions! Anyone else out there want to take a stand?

CC

I'm suffering from R/C culture shock! In California, the racing is great but, I must admit, I had more fun on Long Island where I raced with a small neighborhood club!

We didn't know anything about ROAR, except what we read in your magazine. We created a Spec Class in which every racer had the same car. Now, I know what you're thinking: this would never work on the national level, because there wouldn't be any manufacturer co-operation (except for the company making the car that was used). Our solution was simple—we each ran a stock RC10! This was successful because everyone and his brother owned an RC10 (because of it's monster rep), and only a few racers had to start from scratch. We reasoned that, even if the Spec Class spread to other clubs, a lot of people would be buying RC10s anyway, so it wouldn't matter.

We ran on a rough, asphalt parking lot without the benefit of traction spray, and we used modified motors (with a \$50 limit) and 7-cell SC batteries. The races lasted 5 minutes, we allowed reverse, and we used any kind of wheel and tire that didn't need an adapter. (Molded-rubber tires worked as well as foams!) Were we crazy? Many of my new friends on the West Coast think so! I don't! Is anyone out there listening?!

TONY DeROSA
Sherman Oaks, CA

(Continued on page 28)

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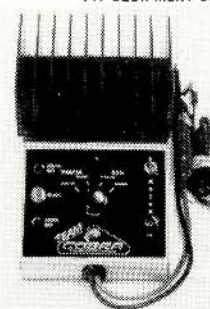


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PL 4518 10L Titanium Rear Pod.....	29.95
AND 3480 RC10 Molded Graphite Chassis.....	39.95
TRC 1451 Capped Tire Spray Cleaner.....	5.95
ANL RC10 Lethal Weapon Trans.....	84.95
RR 500 Robinson Foot Diff' w/Axles.....	54.95
1-SP1 BR MIP RC10 Ball Race Tranny.....	84.95
1-SP1 GD MIP RC10 Gear Diff Tranny.....	\$79.95
San 50 50 MAH 5 Cell Receiver Packs.....	19.95
San 40 50 MAH 4 Cell Receiver Packs.....	17.95

PIT EQUIPMENT STOCKING STUFFERS

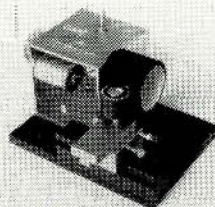
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(Continued from page 27)

You're not crazy! You were fed up and did something about it. I'd say that's a smart way to continue the fun!

CC

IT'S IN THE LOAD

I've seen people fry their speed controllers with modified motors (and witnessed their anger and frustration at destroying new, highly expensive equipment), and I think I have a good idea!

Most electronic speed controllers (ESCs) come with amp ratings written on them, or on the sides of their boxes. If you knew how many amps a motor was going to pull, you could quickly and easily figure out whether you could safely run a particular motor with a particular ESC. Why don't motor manufacturers put "amp-pull" ratings on their motors?! This would save thousands of dollars of wasted equipment and eliminate grief for R/C enthusiasts who don't have the dough for a top-of-the-line ESC!

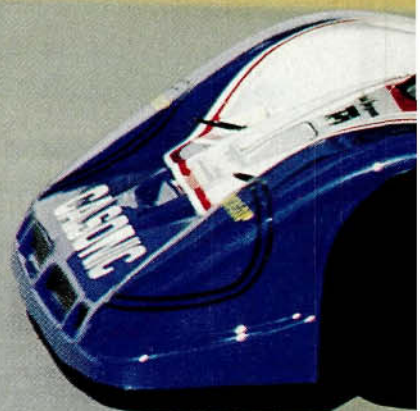
ERIK MORGENSTERN
Redmond, WA

Erik, unfortunately, the current draw is directly related to the load that's placed on the electrical system. A well-maintained car that moves freely and is equipped with ball bearings runs faster and longer because there's less drag within the drive train, and this reduces the load (current draw/amp). High drag within the drive train puts more of a load/drain on the battery, and everything heats up—sometimes, to the point of smoking. For example, you could lock the armature of a stock motor (or even a 540 Mabuchi) with a screwdriver to keep it from spinning, give it full throttle, and smoke a speed controller that's designed to handle even modified motors. Just changing a pinion one tooth in either direction will change the "amp-pull," as you call it. Because of these (and other) variables, manufacturers can't rate their motors with amp draw, the way you suggested.

CC

by JOHN HUBER

DURING THE WINTER, when it's too cold for off-roading, I race indoors on carpet. Near the end of last year, CompositeCraft* introduced the Lynx II, and I encountered new competition for my RC10L! The original Lynx required a lot of work to run consistently, but I've been hearing how great the Lynx II is for months, so I had to see if it really deserved the praise.



PHOTOS BY YAMIL SUED

ECONO-CAT

SPORT OR ELITE?

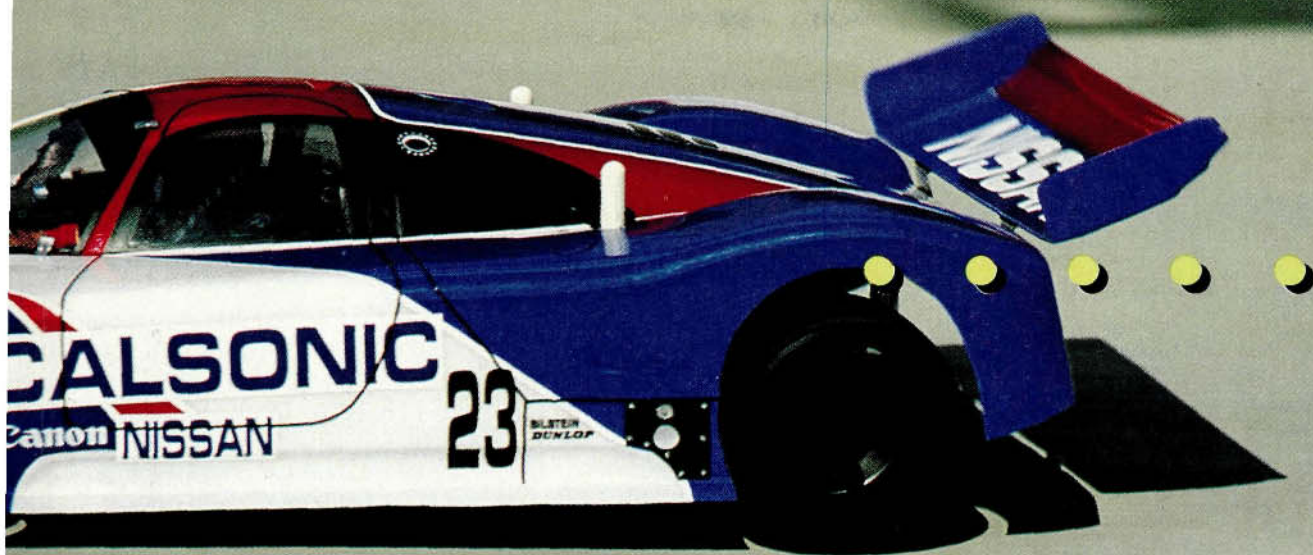
The Lynx II comes in two versions: the Elite and the Sport. I chose the Sport, figuring that I could always modify it into an Elite, if necessary. (Modifying is my favorite part of car construction!) To my surprise, CompositeCraft left me very little to tinker with! The car is loaded with all the good stuff right out of the box!

Both versions come with a graphite chassis, ball bearings and the new full-floating rear pod. The only differences between the Sport and the Elite are the front end, the diff and the motor mount. The Elite has an aluminum motor mount and a Pro-style diff with a $1/4 \times 2/8$ bearing for the spur gear; the Sport has a nylon motor mount with a standard diff. The Sport's front end is a single piece of nylon, and this allows caster adjustments in 2-degree increments. Because the Sport has more nylon parts, it should be lighter.

CONSTRUCTION

Construction begins with chassis preparation. First, file the slots for the cells to prevent a short circuit to the battery. A file will do the job, but a Dremel Moto-Tool is much faster. (It removes

KILLER INSTINCT



COMPOSITE CRAFT / TRC

VNX SPORT

material very quickly, so go lightly and use caution.)

The chassis is much more conductive on its cut edges (like the cell slots) than it is on its face, so take this precaution to prevent any problems: insulate the slot edges by putting a small bead of CA on them. Be careful with this glue, or you might really become attached to your car!

Assembly is easy, and the kit's instructions are excellent. They include detailed pictures, and there's even a section on chassis set-up that explains how adjustments will affect performance. Even if you've never driven a pan car before, you'll know what to do.



COMPOSITECRAFT/TRC LYNX II SPORT

Type On-road
Scale 1/10
Sug. Retail Price \$225

DIMENSIONS:

Overall Length 18.75 inches
Width 9 inches
Wheelbase 9.88 inches
Front Track 7.38 inches
Rear Track 7.5 inches

WEIGHT:

Gross (w/battery) 41.5 ounces

BODY:

Type Andy's RK 90
Material Polycarbonate

CHASSIS:

Type Pan
Material Graphite

DRIVE TRAIN:

Primary Pinion/spur
Transmission Direct drive
Differential Ball
Bearings/Bushings Ball bearings

SUSPENSION:

Front: Type Composite crossbar
Damping None
Rear: Type Floating pod
Damping Oil-filled,
coil-over shock

WHEELS:

Front: Type One-piece plastic
Dimensions (DxW) 1.7x1.5
inches
Rear: Type One-piece plastic
Dimensions (DxW) 1.7x2
inches

TIRES:

Front/Rear Green-dot foam

ELECTRICS:

Motor Not included
Battery Not included
Speed Controller Not included

OPTIONS AS TESTED:

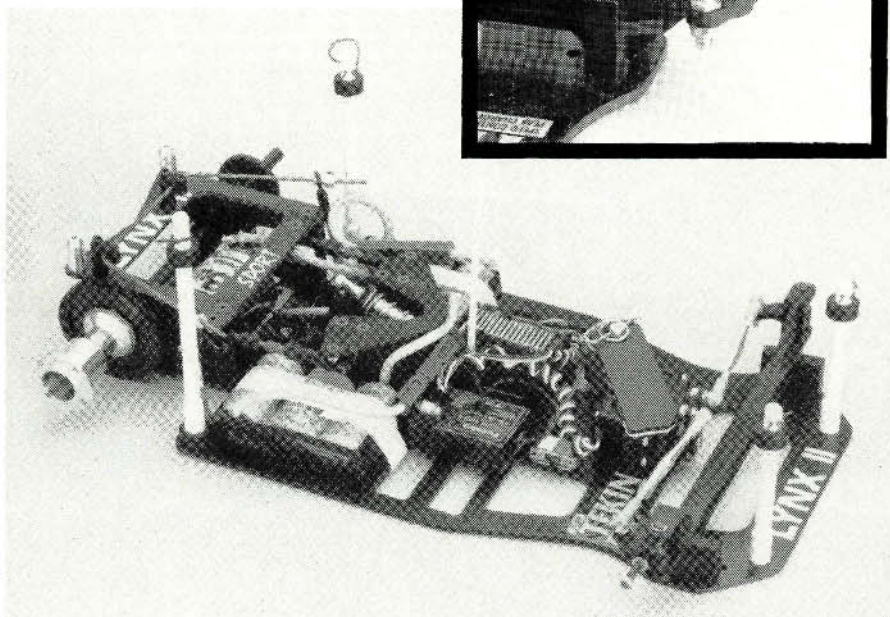
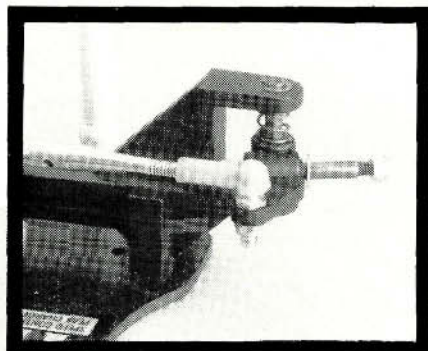
Futaba PCM radio with 132H servo;
Tekin 411P electronic speed controller;
Bud's 13-turn double motor; TRC gold-dot radial tires.

COMMENTS:

Although the steering rods were a little too long and the steel rear links rusted slightly, I was very impressed by the kit. The chassis is made of high-quality graphite, and it's very rigid. This car is great for beginners and experienced racers.

Below: The chassis is almost identical to that of the Elite; but the front crossbar and nylon motor mount are different.

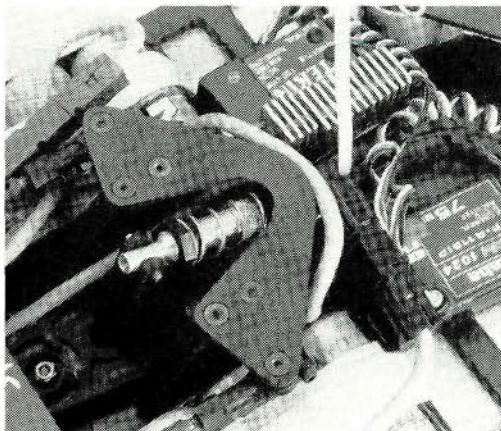
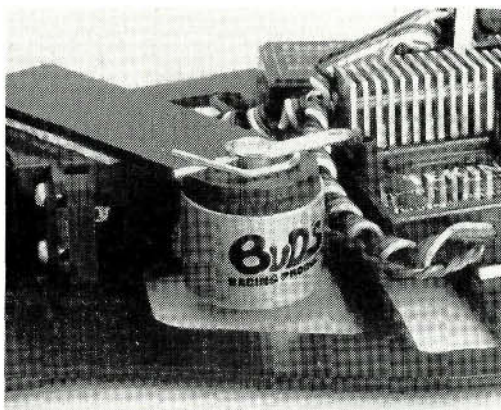
Right: The beefy aluminum tie-rods are threaded in both directions so they can be easily adjusted. Note the aluminum ball links and nut.



What really surprised me was the "little stuff." The car's only locknuts are tiny ones made of aluminum! The ball joints for the steer-

ing and the rear suspension are also aluminum. I like to use this type of "trick" hardware on my cars, but I usually have to hunt for them!

There are no Z-bends in the steering system; that's right—aluminum turnbuckles! I was a little disappointed that I had to cut 1/8 inch off each end, but I did it easily with a pair of diagonal cut-



Top: Bud's practice transponder weight lets you test the car in the condition in which it will be raced. It fits through a hole in the chassis. Bottom: the stock shock absorber worked well, but on a bumpier track, a Kyosho Gold works better.

ters. Be sure to dress the ends of the turnbuckles so that they'll thread into the rod ends.

I've heard of replacing the stock shock absorber with a Trinity purple, or a Kyosho gold, but I wanted to test the stock car. I chose my trusty Futaba* PCM radio and the new Tekin* 411P speed controller, which can handle any kind of motor.

Because I usually run in the modified class, I picked a Bud's* 13-turn double-wind motor; it should really get the Lynx cranking! To make the steering very responsive, I used the Futaba 132H, which has an extremely fast transit time—.13 second for a 60-degree rotation. It takes a steady hand to control this fast steering, so I had to be on the ball.

For the body, I chose the new Nissan RK 90 from Andy's R/C Products*. After I had coated it with a thick layer of liquid mask and cut out the appropriate pieces, I sprayed it with Pactra* red, white and blue

(Continued on page 78)

Christmas

Wish List

St. Nick's
hot R/C
picks



It's beginning to look a lot like free stuff—oops, I mean Christmas—everywhere I go! Let's face it, we're all thinking of the presents we can get on December 25 if we start harping on our family members now; it's called the *modern* Christmas spirit.

If you get a severe case of stuttering when asked, "And what

would you like Santa to bring you?"—just open *Car Action* to this page, make enough photocopies for everyone and hand them out; it's simple and yuppyishly efficient! Never again will you have to risk sounding phony—"Thanks very much for the underwear, Aunt Tilly; it's just what I needed"!

MASAMI'S MACHINE

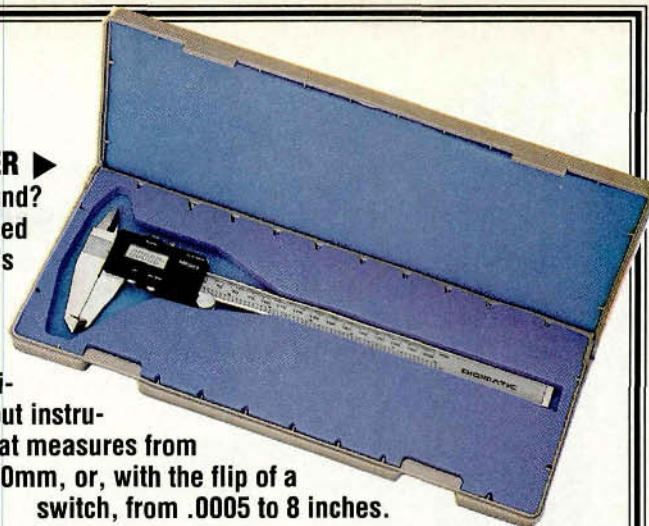
We'd all like to have the World Championship-winning car, but I think its owner might have something to say about that! The next best thing, of course, is to get your own YZ-10, and then set it up just like the champ's. For all the details, see the article, "Inside Masami's Machine" in *Car Action's* November '90 issue.



MITUTOYO CALIPER ►

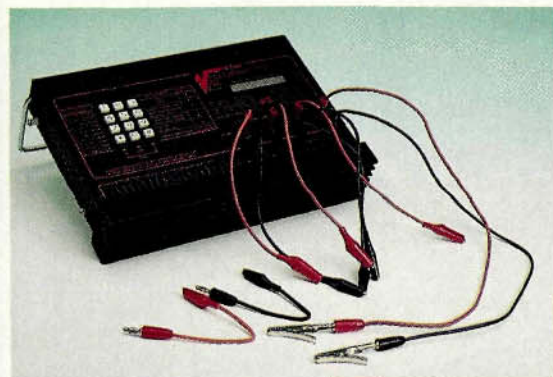
Ever tried to take an accurate reading of something round? Whether it's an inside or outside measurement, you need a micrometer to do it accurately. Mitutoyo Corp.'s

Digimatic is a highly precise, digital read-out instrument that measures from 0.01 to 200mm, or, with the flip of a switch, from .0005 to 8 inches.



▲ BADGER AIRBRUSH

Here's something all modelers want—but often put off getting because of other modeling needs—so it's the perfect gift. The Badger 100 comes with two needles, two heads, three cups and a hose—all in a strong wooden box. This airbrush is a necessity if you want your car to look as good as it runs!



HIGH CALIBER ►

Want your loved one to have a high-caliber intimidator the next time he or she goes to the track? Put the new Airtronics FM Caliber under the Christmas tree, and turn him/her into Robo-Racer! The reversible (left-hand/right-hand) Caliber has an LCD display, memory storage for three cars, a higher-power-output, interference-resistant transmitter and a low-voltage alarm. If your favorite racer always complains, "I hate having to take three transmitters to the track," either tell the spoiled brat to shut up, or buy an Airtronics Caliber!



▲ HI-IQ

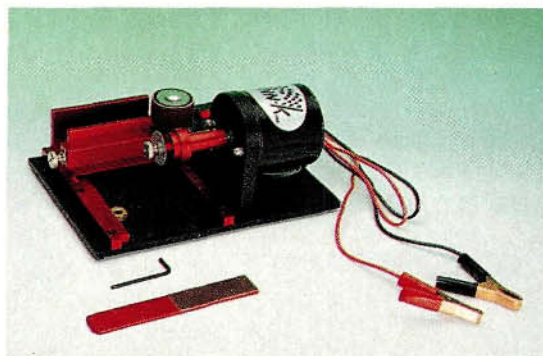
The Victor Engineering Hi-IQ is a charge/discharge/cycling/grading/matching unit that can be interfaced with a PC. The user-friendly Hi-IQ can test your motor's current and your speed controller's efficiency. With many other functions, it's a truly versatile trackside helper.



◀ UNIMAT PC

Even the modeler who has everything might not have Emco Maier's computer-controlled lathe/milling machine—the Unimat PC. This precision power tool is small, but powerful. Connect it to your IBM PC (or a compatible one), and the possibilities are limited only by your creativity! Throw in the graphic-aided software, and you'll never come out of the basement. If escaping is your goal, so much the better!

Christmas Wish List



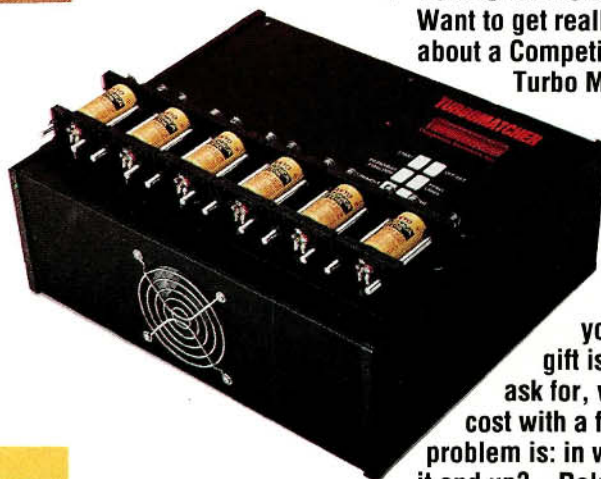
◀ TIRE TRUER

Here's another communal Christmas-purchase possibility—the Twinn-K tire truer. This unit is made of anodized red aluminum, and it does a very accurate job of truing on-road foam tires. Wait a minute!—forget the communal purchase: buy the Twinn-K Tire Truer yourself, and charge all your “good friends” a fee to use it!



▲ DREMEL MINIMATE

Ever need to make a quick between-heat repair that required cutting or filing?—sure you have! At times like that, every serious racer could use a Dremel Cordless Minimate precision rotary tool. This stocking stuffer comes with a wall-mounted charger (complete with an LED) that does the job in 3 hours. Also included are assorted grinding, cutting and sanding attachments.



▼ TURBO MATCHER

Want to get really fancy? How about a Competition Electronic Turbo Matcher to build your own matched racing packs, complete with cell labels and graph read-outs (when used with your printer). If this gift is too expensive to ask for, why not share the cost with a fellow racer? The problem is: in whose house will it end up?—Ralph's or Norton's?! Flip a coin!



MA 70T ▶

Racers are always concerned with getting a constant supply of DC power. Here's the answer—Monolithic Supply Inc.'s MA70T, which is available through Stormer Racing. It supplies a clean source of up to 20 amps of DC juice through one of the two 12-volt outputs that will operate peak-chargers, and up to 70 amps of juice through the low voltage output for powering motor lathes and dynos—without the noise that often interferes with their operation. At home or at the track, the MA70T will make your racing buddies green with envy!



◀ CAR ACTION, OF COURSE!

What kind of a yuletide would it be without the comfort of knowing those fat issues of *Car Action* will show up at your door for another year—at least?! Now you have all you need!

Inside **Cliff Lett's WINNING CARS**



R O A R OFF-ROAD NATS WINNERS

by STEVE POND



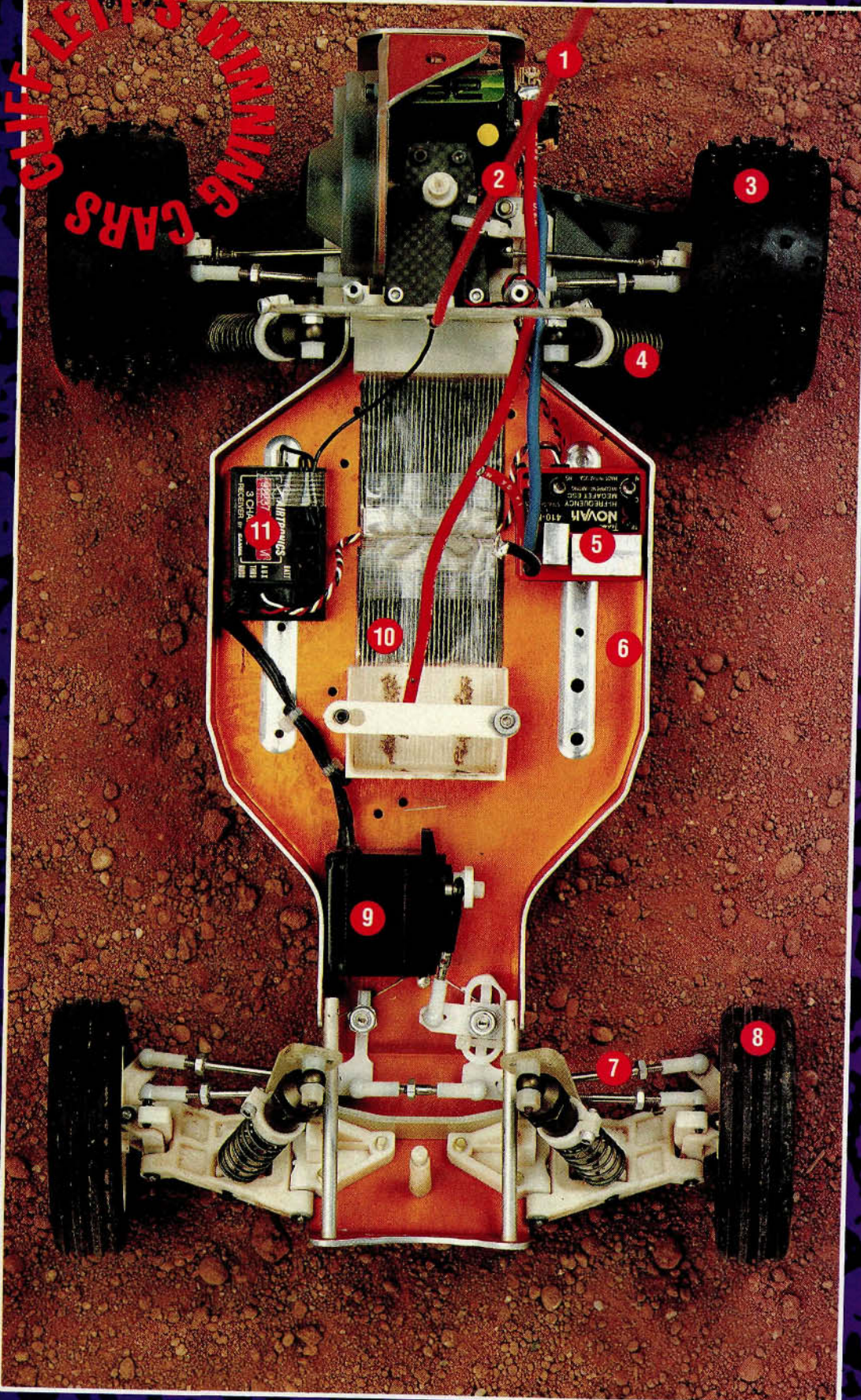
Each year, the nation's top drivers compete for the country's most prestigious off-road title—the ROAR Off-Road National Championship. Two classes attract the most attention—Modified 2WD and 4WD—and the competi-

tion is always fierce. There are no flash-in-the-pan winners here!

Defending 4WD champion, Cliff Lett (Team Associated), repeated his victory in 4WD and took the 2WD title for a clean sweep of the Modified Class!—the only racer who has ever done this!

Cliff agreed to Lett (ha, ha!) us look closely at them and the mods he made, and in the following pages, we show YOU!

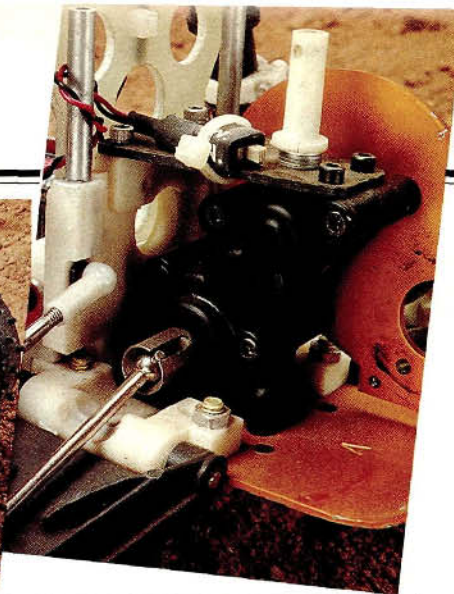
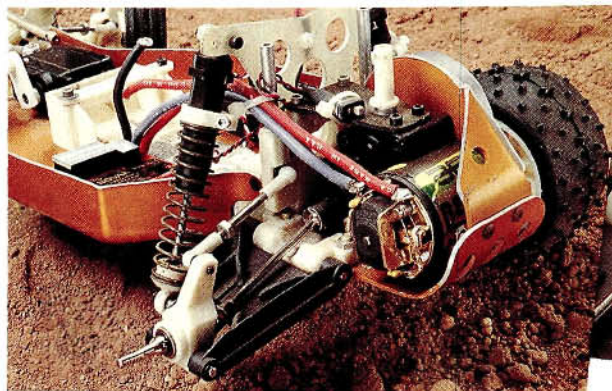
CUTLET'S WINNING CARS



1. Reedy Modified 16-turn Yellow Dot motor
2. The infamous Stealth tranny with graphite upper brace
3. Losi HT X-pattern tires with trimmed spikes
4. Hard-anodized Associated shocks.
5. Novak 410-M1c
6. Stock RC10 aluminum chassis. To reduce weight, the sides and front were machined slightly.
7. RCPS titanium turnbuckles
8. Losi HT ribs
9. Airtronics ERG-XS boosted steering servo
10. A layer of tape prevents the battery from shorting on the chassis. Slots to either side of the battery box allow dirt to fall out of the car while running.
11. Airtronics radio system

■ *Far right: Lett's RC10 has a slightly modified aluminum chassis, hard-anodized shocks and universal-joint drive shafts.*

■ *Right: The "Stealth" transmission used during the World Championships was also used by Lett to win the Nats. This transmission should be on the hobby shop shelves by the time you read this.*



THE WINNING RC10

Lett's RC10 began as a basic RC10 Championship Edition car with an aluminum chassis plate (that's right, *aluminum!*). Starting with the front suspension, Lett swapped the stock RC10 shocks for a hard-anodized version that team drivers have been testing on their cars for some time. (The hard-anodizing allows the shock piston to move with less friction, and this substantially reduces wear.) When asked whether these shocks would make it to the hobby-shop shelves, Lett told us that there's another type being developed. It's even better than those used on his car, and it should be available this winter!

To control front-end damping, Lett used Team Associated's* new silicone shock oil (a combination of 20WT and 30WT) with the standard piston and shaft assembly. The shocks themselves are the longer of the two Associated front shocks (no. 6448) with the soft, green springs (no. 6494). The front shocks are mounted in the highest hole

on the shock tower, and their lower ends are at the outermost hole on the suspension arm. To reduce tire scrub when cornering, the car has Associated 25-degree-caster blocks and the new in-line steering blocks.

(Continued on page 50)

ASSOCIATED ELECTRICS RC10

Type 2WD off-road
Scale 1/10

DIMENSIONS:

Overall Length 15 inches
Width 9.5 inches
Wheelbase 10.625 inches
Front Track 9 inches
Rear Track 7.75 inches

WEIGHT:

Gross (w/battery) 54.05 ounces

BODY:

Type RCPS Turbo Mirage
Material Polycarbonate

CHASSIS:

Type Pan
Material Aluminum

DRIVE TRAIN:

Primary Gear

Transmission Geared
Differential Gear
Bearings/Bushings Ball bearings

SUSPENSION:

Type (f/r) Single A-arm w/upper control link
Damping (f/r) Oil-filled, coil-over shocks

WHEELS:

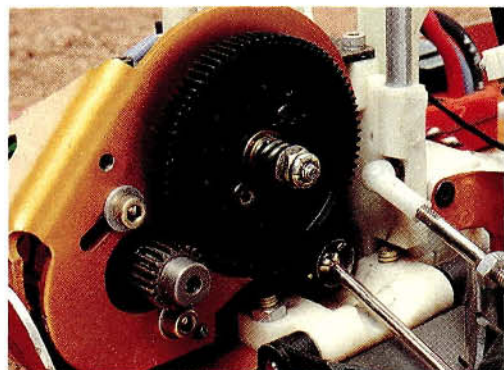
Front: Type One-piece
Dimensions (DxW) . 2.125x.75 inches
Rear: Type One-piece
Dimensions (DxW) 2x1.5 inches

TIRES:

Front Ribbed
Rear Losi X-pattern

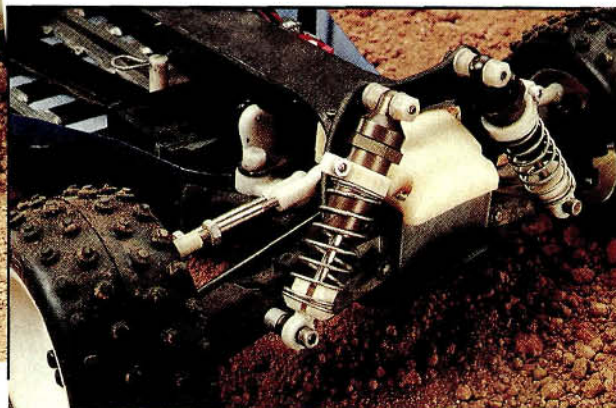
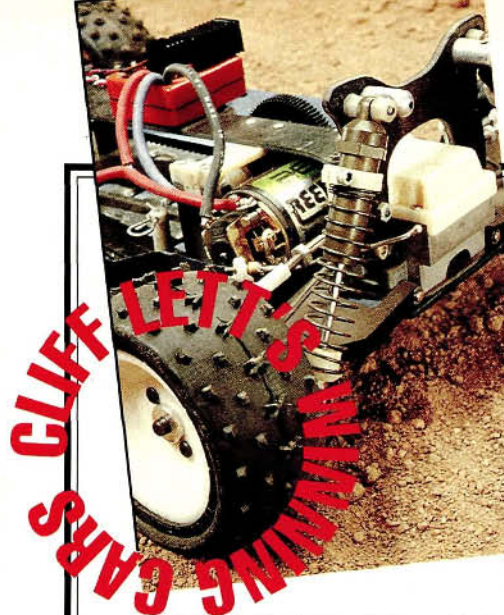
ELECTRICS:

Motor Reedy Modified
Battery Reedy
Speed Controller Novak 410-M1c



■ *Far left: The opposite side of the Stealth tranny shows the absence of a diff apparatus, which is now safely inside the housing.*

■ *Left: On a car that won the Nationals, you might expect a lot of "trick" hardware, but it has all the stock steering linkage.*



■ Far left: For smoother operation, the rear of Lett's car has Losi X-pattern tires, custom-made suspension arms and hard-anodized shocks.

■ Left: To prevent the front bulkhead from breaking, Lett uses a custom-made shock tower, and he also uses hard-anodized front shocks.

THE VICTORIOUS YOKOMO YZ-10

Of the two cars with which Cliff Lett won the National Championship, the YZ-10 he drove in 4WD Modified was by far the more modified. He not only tinkered with its motor and batteries, but also with the chassis!

Lett tossed the stock front Yokomo* shocks in favor of long Associated hard-anodized ones (no. 6448), and, for damping, he used standard pistons and shafts with Associated's 40WT silicone shock oil. A custom-made shock tower angles the shocks inward to provide more

progressive damping and to prevent undue stress on the bulkhead, which is prone to breaking.

To give the car a slightly wider stance and to reduce tire scrub during radical suspension movement, Lett modified a pair of rear A-arms for the front end. They were adapted to use the Yokomo wide front-end kit and longer universal-joint drive shafts. At the end of the front suspension arms are Kyosho* block carriers, which add 15 degrees of caster. To raise the pivot point for the steering linkage and to minimize bump-steer, the SRS* steering hubs are mounted upside-down.

The YZ-10's rear sus-

TEAM YOKOMO YZ-10

Type 4WD off-road
Scale 1/10

DIMENSIONS:

Overall Length 16 inches
Width 9.5 inches
Wheelbase 10.7 inches
Front Track 8 inches
Rear Track 8.25 inches

WEIGHT:

Gross (w/battery) 55.33 ounces

BODY:

Type Single-seat buggy
Material Polycarbonate

CHASSIS:

Type Pan
Material Graphite

DRIVE TRAIN:

Primary Gear

Transmission Belt
Differentials Ball diffs
Bearings/Bushings Ball bearings

SUSPENSION:

Type (f/r) Single A-arm w/upper control link
Damping (f/r) Oil-filled, coil-over shocks

WHEELS:

Type (f/r) One-piece nylon
Dimensions (DxW) (f/r) 2.2x1.5 inches

TIRES:

Front Losi 4-row spike
Rear Losi X-pattern

ELECTRICS:

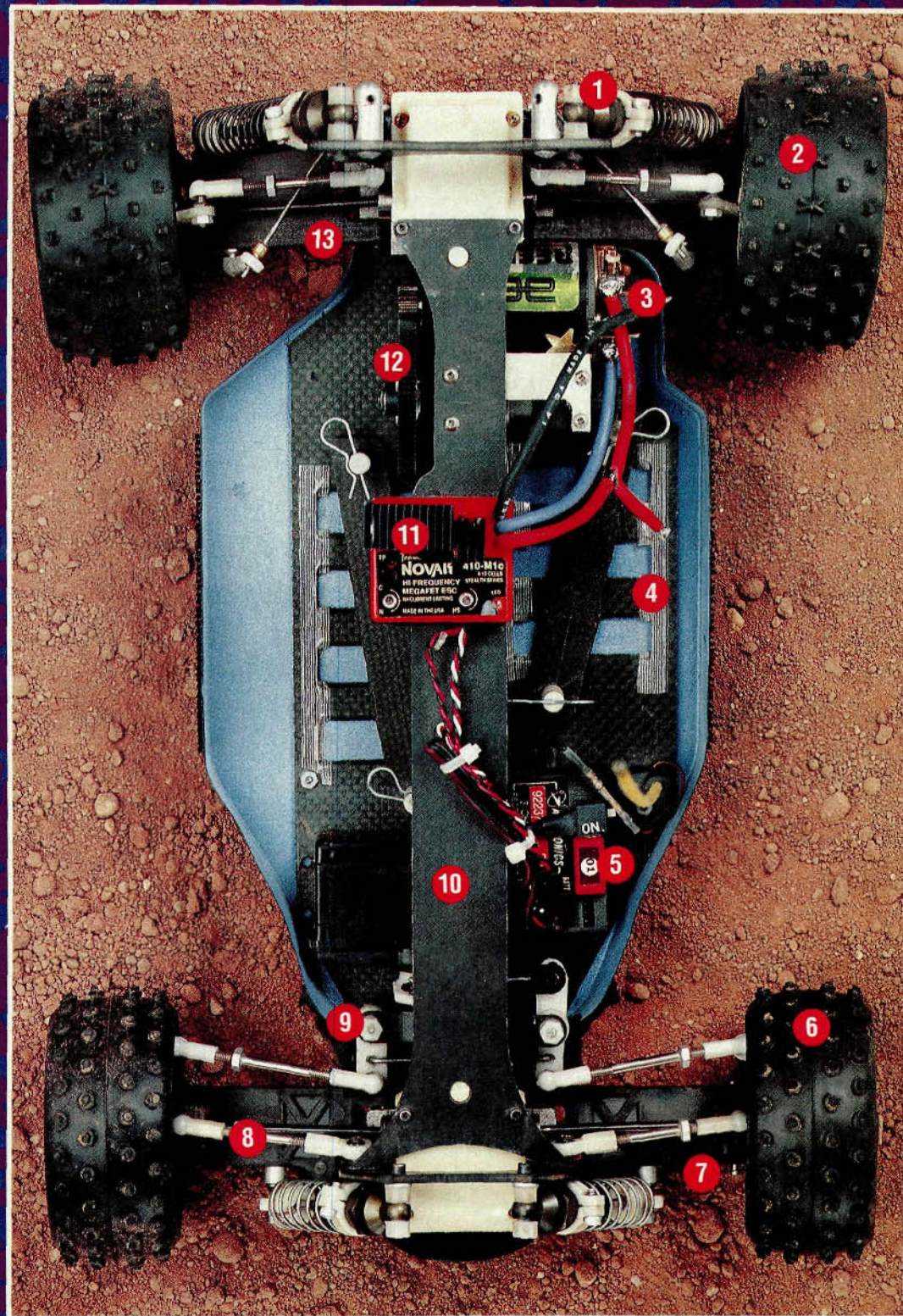
Motor Reedy Modified
Battery Reedy
Speed Controller Novak 410-M1c



■ Far left: The highly modified front end of Lett's car has Kyosho hub carriers (for more caster), SRS steering blocks, and RCPS titanium turnbuckle linkage.

■ Left: The rear bulkhead suspension has mounting points that are about 1mm lower than stock (for more ground clearance) and a custom shock tower.

1. Associated's new hard-anodized shocks are used on all four corners.
2. Losi HT X-pattern tires hold the rear of the car to the ground.
3. Reedy Modified 14-turn Gold Star motor
4. Custom graphite chassis
5. Airtronics radio system
6. Losi HT four-row spike tires
7. Rear A-arms up front, fitted with Kyosho block carriers for additional caster and new nylon steering knuckles.
8. RCPS titanium tie rods
9. A servo brace prevents the steering posts from flexing from side to side during travel.
10. Jammin' Jay's upper chassis stiffener
11. Novak 410-M1c
12. Yokomo gear adapter (#ZC641G)
13. Custom-machined rear A-arms



pension is fitted with short Associated rear shocks that are hard-anodized (for smoother operation), equipped with .10-inch travel-limiting spacers and filled with Associated 30WT silicone oil. Lett also used green springs and mounted the shocks on a custom-made rear shock tower and the hand-made, nylon, rear suspension arms.

These custom suspension arms are designed to widen the rear stance slightly (to increase stability), and to use the RC10 hub carriers which, in a roundabout way, result in less

tire scrub. To modify the carriers to accept the long Yokomo universal dogbones, he deepened the bearing cavity (by machining). To allow enough clearance on the inside of the Yokomo wheels, Lett attached small fiberglass brackets to the modified hub carriers.

A single anti-roll bar that's made of .062-inch-diameter wire keeps the car stuck to the ground. Other suspension mods include a set of RCPS titanium turnbuckles and link-

(Continued on page 51)

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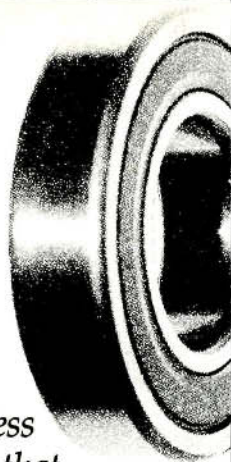
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THE WINNING RC10

(Continued from page 47)

The rear suspension has the longer Associated rear shocks (no. 6446), which have also been hard-anodized; standard pistons and shafts; the longer soft; green springs (no. 6480); and Associated's 30WT silicone oil for damping. On both rear shocks, .400-inch travel-limiting spacers prevent the universal-joint drive shafts from pulling out of the drive cups when the suspension is extended. The shocks are mounted in the inner hole on the shock tower and the outermost hole on the suspension arms. Other suspension mods include a complete set of RC Performance Specialties* (RCPS) titanium hinge pins and turnbuckles.

The chassis is slightly lighter than the basic kit version. You might think that the slots and holes machined in the bottom are there to reduce weight, but, in fact, they allow dirt to fall out. This is a great idea, because dirt increases weight and affects handling.

To get the car rolling, Lett chose a pair of Team Losi HT X-pattern tires for the rear and HT ribbed tires for the front—all mounted on TQ wheels.

One of the car's most substantial modifications is the new "Stealth" transmission (a radical departure from the original one), which the Associated Team and Masami Hirosaka used to dominate the IFMAR World Championships.

Power comes from a Reedy* Modified 16-turn Yellow Dot motor with a 20-tooth pinion and an 84-tooth spur gear that's linked to a new Novak* 410 M1c speed controller. As for batteries, you might think that, as a factory-sponsored driver, Lett used super-matched 50-bazillion-second packs to win the 2WD title. Nope! He used an off-the-shelf Sanyo* 7-cell pack with braid soldered to its end to allow hard-wiring! An Airtronics* CS2P-FM transmitter using the new Airtronics ERG-XS servo completes the electronics. This servo has a booster built right into it! (Servo-boosting gives faster steering response and more torque to withstand heavier loads.)

An RCPS Turbo Mirage body with custom painting by Curtis Hustings tops-off Cliff Lett's 1990 Nationals winner. In the immortal words of Howard Cosell, "There you have it, folks!"

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DIALED
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THE VICTORIOUS YOKOMO YZ-10

(Continued from page 49)

ages. Lett chose Team Losi* HT X-pattern tires for the rear and Losi HT four-row spikes for the front—all mounted on standard Yokomo white wheels.

The custom graphite chassis is the one that Lett used to compete in the IFMAR World Championships, but for a shorter roll moment, he moved the battery slots forward and toward the center of the car. (A shorter roll moment simply means the car is able to recover more quickly from a roll.) To stiffen the car's chassis, Lett swears by the Jammin' Jay Halsey upper plate, and he used an RCPS steering brace for a more rigid steering assembly.

To improve acceleration, Lett lightened both the front and rear differentials. They use an RCPS diff kit, which keeps the drive rings from spinning under hard acceleration. The car has standard belts, pulleys and bearings (with the exception of the Boca* outdrive bearings), and a Yokomo spur-gear adapter accommodates standard spur gears. The adapter has two one-way bearings, which provide positive power transfer to the front end.

Last, the accessories. Lett's championship Yoke uses the new Novak 410 M1c high-frequency speed controller, a Reedy Modified 14-turn Gold Star motor and a pack of Reedy matched cells. To control the car, Lett chose an Airtronics CS2P FM transmitter and a ERG-XS boosted steering servo. The finishing touch?—an Associated YZ-10 Protech 4 body painted by Curtiss Hustings.

Congratulations to Cliff Lett and Team Associated for sweeping the ROAR Off-Road Nats.

*Here are the addresses of the companies mentioned in this article:

Associated Electronics, Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626.

RC Performance Specialties, 18312 Gifford St., Fountain Valley, CA 92708.

Reedy Co.; distributed by Associated Electronics.

Novak Electronics, Inc., 128-C E. Dyer Rd., Santa Ana, CA 92707.

Sanyo Electric, Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.

Airtronics, Inc., 11 Autry, Irvine, CA 92718.

Yokomo; distributed by Associate Electronics.

Kyosho/Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

SRS, 1120 N Hayden Rd., Tempe, AZ 85281.

Team Losi, 1655 E. Mission Blvd., Pomona, CA 91766.

Boca Bearings, 7040 W. Palmetto Park Rd., Boca Raton, FL 33433. ■

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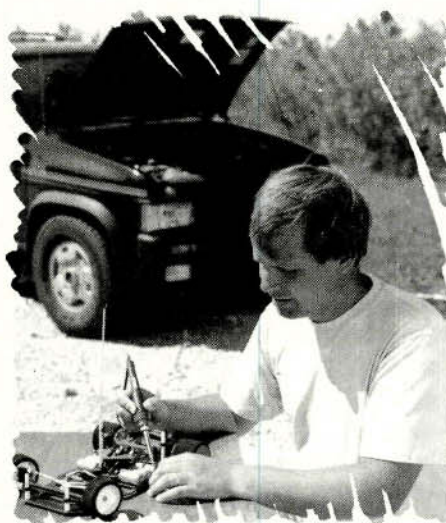
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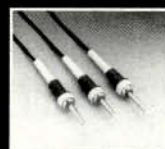
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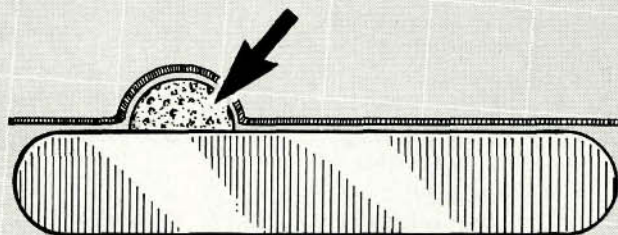
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PIT TIPS

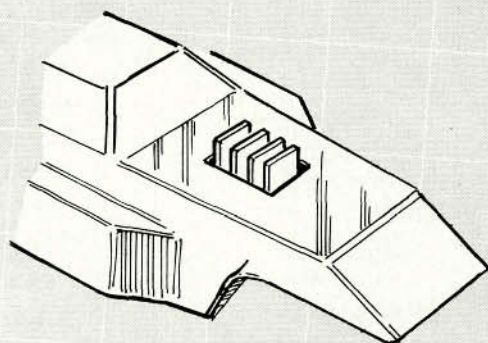
by JIM NEWMAN



FOX 6-CELL PACK

To ensure that a 6-cell pack won't rattle around in the battery holder of your Fox, glue half a cork to the top of the Ni-Cds (arrowed) so that it fits into the recess normally occupied by the hump on a 7-cell pack.

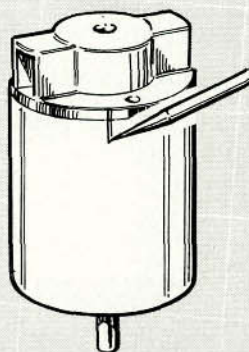
John Mah, Scarborough, Ontario, Canada



SPEED CONTROLLER COOLING

Here's a speed controller cooling method that works well on the RC10. Cut a square hole in the hood of the car, bend the mounting brackets to raise the controller, and mount it so that the Mosfet tabs are out in the breeze.

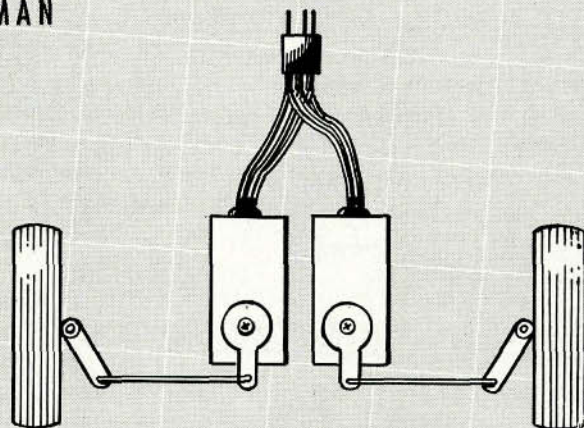
Tim Naab, Safety Harbor, FL



ENDBELL ALIGNMENT

Here's a clever way to make sure your endbell isn't fitted back to front. Before removing it, use a sharp, pointed tool and a straightedge to scratch a line across the edge of the endbell and the motor can. When you reassemble the motor, simply line up the marks!

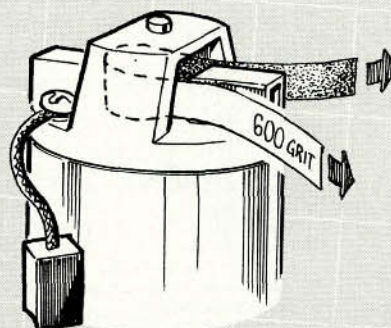
Steve Lussier, Pittsfield, MA



INCREASED SERVO POWER

Here's a way to increase steering power on a Monster Beetle, Blackfoot, or Frog. Install two servos so that each steers just one wheel. Cut and solder their wires as shown, so that they plug into the one receiver socket. Now you can operate the servos together.

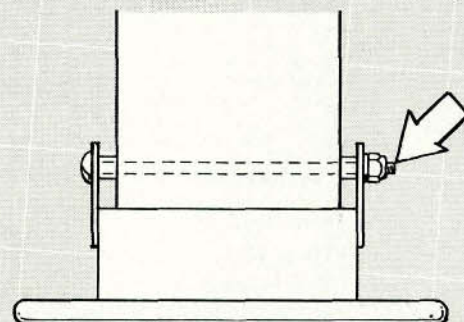
Kenny Ferrera, Virginia Beach, VA



COMMUTATOR POLISHING

Want a clean, highly polished commutator? After removing the brushes, slip a narrow strip of 600-grit sanding film past the brush housing, around the commutator and back out past the brush housing. Pull the tabs gently to tighten the film against the commutator, slowly spin the motor's armature by gripping the shaft in the chuck of a variable-speed drill, and move the sanding strip up and down. Use an air jet to "blast" the dust off your restored commutator.

Mike Wheelock, Pocatello, ID



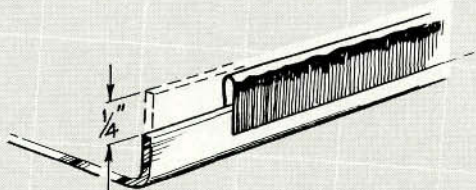
BIG BRUTE BUMPER MOUNTING

Does your Big Brute have fragile bumper-mounting tabs? Here's a solution: run a long bolt through the bulkhead and the tabs. The simplified sketch shows how.

Adam Rondinone, Kernersville, NC

PIT TIPS

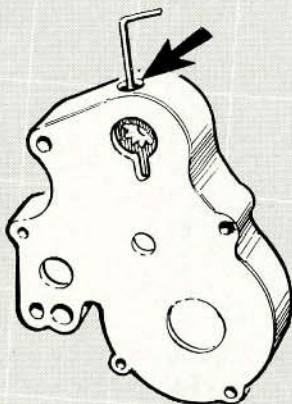
by JIM NEWMAN



NO-SCRATCH OPTIMA CHASSIS TRAY

To prevent the sharp edges of a new chassis tray from scraping the paint on your Optima body, cut the tray approximately 1/4-inch lower, and attach plastic electrical tape to the edges. Leave some sticking up above the chassis to act as a bumper guard.

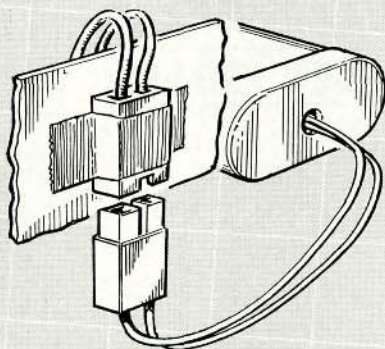
Taylor Sherman, Issaquah, WA



SPEEDY PINION REMOVAL

It's possible to change the pinion on a Blackfoot, Frog, Monster Beetle, or Brat without removing the motor. First, drill a 1/4-inch-diameter hole in the top of the gearbox. Then, simply loosen the motor-mounting screws, loosen the pinion screw by inserting an Allen wrench in the hole, and slip out the pinion. Reverse this procedure when fitting the new pinion, and don't forget to tighten the motor mount!

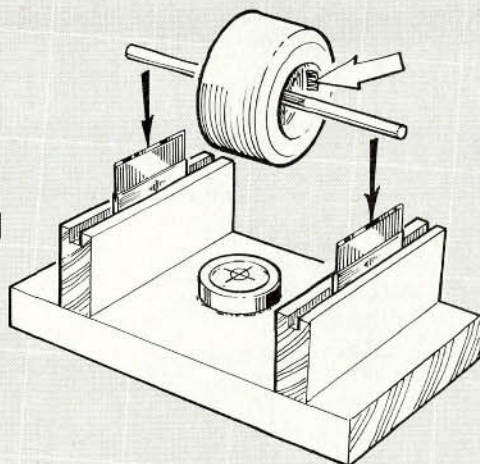
Dan Keen, Pitman, NJ



KYOSHO BATTERY PLUG

Some Kyosho owners have trouble connecting the battery plug to their speed controllers because the body gets in the way. Here's a solution: tape the plug to the side of the body with a piece of electrical or duct tape.

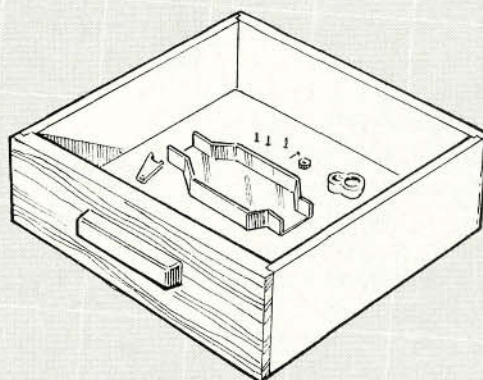
Mike Stahl, Chesterfield, MO



WHEEL-BALANCING JIG

If you use a table saw, it's easy to build this balancing jig accurately. Cut all the wooden parts square and cut the slots for the single-edge razor blades. Glue a bull's-eye bubble level onto the center of the jig, and place paper shims under the edge of the base until the jig is level. (Inexpensive bubble levels are available at hardware stores.) Slide the wheels onto a close-fitting spindle, lower them onto the blades, and spin gently. Determine the heavy point, i.e., the part of the tire that always stops at the bottom, and mark it with chalk. Balance the tire by sticking small bits of masking tape inside the rim as needed (arrowed).

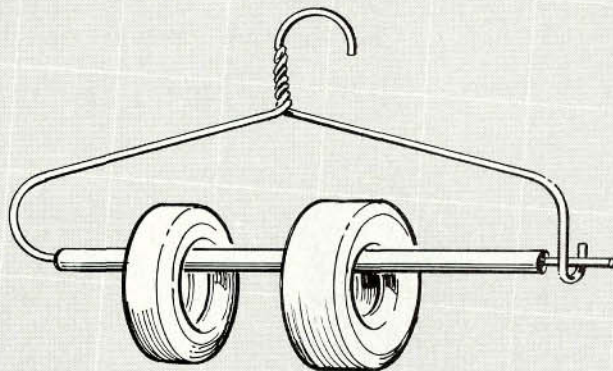
John Marcotte, Mahwah, NJ



NO-LOSS ASSEMBLY TRAY

To prevent parts from getting lost, assemble your car in a drawer. No loose parts can bounce away, and when you want to stop working on the car, just slip the drawer back into the chest until next time!

Mike McGinley, Tucson, AZ



TIRE CADDY

Cut and bend a wire coat hanger so that it looks like a giant safety pin. Slip your spare tires onto a cardboard tube (this will protect the bead), close the "safety pin," and hang your tire caddy in a convenient place.

Jason Pape, Lancaster, CA



by STEVE POND



TWO HUNDRED racers from all over the country came to test their skills on a formidable track with fast straightaways, tight hairpin turns, "table tops," agitator bumps and a high-bite surface. Hosted by the Team SEMROCC Club of Detroit, MI, the Speedworks Sportsman's Cup Race was the second in a series of three this year and the first to be run off-road. This type of excitement was nothing new for the Detroit Club, because it was the site of last year's ROAR Off-road Nationals, and it will also be the site of next year's IFMAR Off-Road World Championships.

SPORTSMAN'S CUP

Do
Dirt!





The 4WD-Class race was very close; many racers turned in fast, eight-lap runs, and the fastest drivers completed nine laps.

Team and sponsored drivers weren't allowed to compete, so average racers had a good chance of success. The Invitational and pro drivers only ran in an

exhibition heat, and they were primarily there to help racers set-up their cars (through the many seminars, or one-to-one). The competition was restricted

to stock-class motors, so racers just focused on their cars' setups. As a bonus, Bill Jeric and Tom Grog of Great Planes Model Distributors organized an exhi-

bition heat of Kyosho's new Turbo Burns 1/8-scale gas-powered off-landers to show electric racers just how fast and how much fun these cars can be.

Several invitational exhibitions were held during the Sportsman's Cup event. In six heats, drivers piloted the new Kyosho Turbo Burns 1/8-scale off-road cars. Great Planes' Bill Jeric organized the exhibition to

sis, a shaft drive with bevel-gear differentials, a torque-splitting center differential, 4W independent suspension, disc braking and a host of other high-performance goodies that make this one of the most ferocious off-



Mike Burnette (right) divided his time between the 1/8- and 1/10- cars.

cars aren't meant to replace electric cars, which are here to stay. Kyosho wants to offer racers a powerful addition to

their electric racers.

The races lasted 10 minutes with one fuel stop at about the 6-minute mark. To fuel the car, a pit crew pulled off the top of the quick-fill tank, inserted a bottle of fuel and gave it a squeeze. When the tank was

Motor City Methanol Madness...

show racers how easy, fast and exciting nitro-powered racing can be.

The Turbo Burns is powered by a .21 cubic-inch (3.5cc) engine that produces about 2hp and moves an 8-pound car. Its features include a plate aluminum chas-

road cars ever. This isn't the 1/8-scale car of old; it's a new breed that's *extremely* durable and reliable.

The car's appearance can be deceiving when it's running solo on the track. You might think a 1/10-scale car could keep

up with it, but when it comes to putting the ponies down side by side, the Burns will suck the Lexan right off an electric car.

Although Bill Jeric is promoting 1/8-scale off-road racing in the States, he says these

With his white Turbo Burns, Joel Johnson dominated the 1/8-scale exhibition heats for an overall win in the class.

SPORTSMAN'S CUP



■ Inset: First-turn action was always a scramble for position, as this 2WD heat demonstrates.

■ Above: Invitational drivers who gave the seminars, also ran a series of demonstration heats.

There were seminars on chassis and motors, and there was a free-for-all in which Invitational racers fielded questions about every aspect of racing. During the 1/8-scale racing, those interested in 1/8-scale cars had a chance

to ask the experts any questions.

DAY 1

FRIDAY, JULY 6: an open day of practice when racers could dial-in their cars to the track. Starting from the staging area, they blasted down the longest section of the track, then the back straight and on into a 90-degree right turn. A short stretch led them into a 180-degree left turn that sent them uphill into a 180-degree right. From there, it was downhill over a couple of jumps and into a 90-degree right turn that led to a short straight with multiple "agitator bumps." At the end of the short straight, racers faced another 90-degree right, then two 90-degree lefts and



The 1/8-scale cars started LeMans style. Pit crews hold the cars in the air until showtime:

full, the tank cap was released and the car went

on to finish the race. Average pit stops took

about 4 seconds.

Nitro-burning engines produce excellent horsepower and add realism to any race. They'll give you more track time in one heat of an average race than you'll get with an electric car over an entire weekend. Once you get your hands on one of these cars, you'll be hooked!



2WD STOCK CLASS

Fin	Qual	Name	Laps	Time
1	8	Joe Kolp	8	4:0.19
2	2	Tim Richie	8	4:1.89
3	9	Pat McCreery	8	4:2.28
4	5	Mike Boekdrukker	8	4:4.58
5	7	Dave Meredith	8	4:6.73
6	1	Timothy Mottin	8	4:12.71
7	4	Scott Moody	8	4:15.79
8	10	Anthony Lewis	8	4:16.50
9	6	Pete Costigan	8	4:21.99
10	3	Bobby Stroud	7	3:47.78

4WD STOCK CLASS

Fin	Qual	Name	Laps	Time
1	3	Greg Baumel	9	4:24.08
2	1	Mike Boekdrukker	9	4:24.52
3	5	Paul Morack	9	4:27.21
4	8	Kevin Montalbano	9	4:27.60
5	2	Scott Williams	9	4:28.09
6	4	Scott Reid	9	4:33.53
7	6	Dave Henry	8	4:1.01
8	9	Randy Coleman	8	4:3.43
9	10	Stephen Koo	8	4:7.11
10	7	Rob Press	8	4:12.77



Master of Ceremonies Ernie Provetti fields questions during the very popular chassis seminar.

yet another 90-degree to the right. This put them into a right-hand sweeper that led to a mountainous "table top" and then to the back straight to complete a lap. The high-bite surface made tire selection easy, and proper suspension set-up turned out to be crucial.

Throughout the weekend, "Dyno" Dave Willems was set up with a dyno to tune the motors of racers who were having a

tough time making good horsepower. The racers used Speedworks 23-turn stock motors, which provided plenty of speed around the twisting track, but had horsepower that was manageable for most people.

At the end of Friday's practicing, SEMROCC members groomed the track for Saturday's two qualifying rounds.

DAY 2

FIGHTING FULLER



While in Detroit, MI, for the Speedworks Sportsman's Cup Off-Road race, I heard about a 17-year-old local racer who has cystic fibrosis. Ralph Fuller usually manages to keep his spirits *preety* high, but he's occasionally overwhelmed by the symptoms and has to be hospitalized. Ralph is such an avid R/Cer that he not only took his RC10 to the hospital, but he also took his entire library of *Car Action* mags! He keeps busy by reading, or working on his RC10, and he aims to be back on the track as soon as possible.

One of Ralph's close friends told ROAR Administrator John Thawley that Ralph would love to meet Joel "Magic" Johnson, and since he was in Detroit for the race, there would never be a better time! Joined by John Thawley and Ernie Provetti, Joel and I headed to the hospital to see if we could give Ralph's spirits a lift.

Needless to say, Ralph's eyes brightened when Joel walked in! We had a great time—shooting the breeze about racing, car set-up and other R/C stuff—we hope to see Ralph in the *winners' circle*!

SATURDAY, JULY 7: the 1/8-scale Kyosho cars were the first on the track. Although the race was an exhibition, points were awarded for each of the 10 heats, and the racer with the best average walked away with top honors. The drivers who joined me for this were, Joel Johnson, Carl Christy, Bud Bartos, Mike Burnette, John Palmer, Bill Kolioplous, Jeff Smaltz, Bill Jeric and Jim Hoffman.

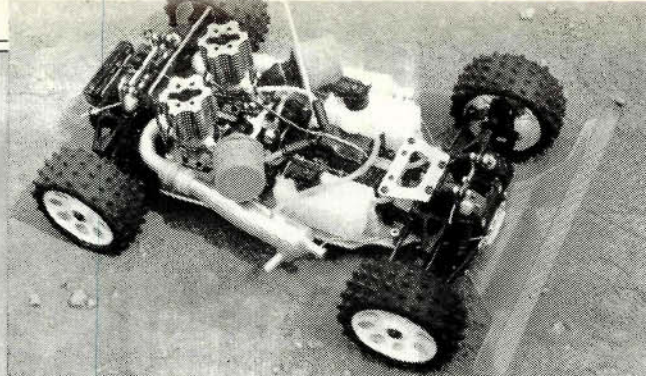
Then the 2WD class lined up for the first of three qualifying rounds, which were followed by

DOUBLE TROUBLE

Creative R/C car enthusiasts are always modifying their cars to improve performance, achieve a certain "look," or to change their intended applications. It's a way to add a personal touch.

During the 1/8-scale gas-power exhibitions, Don Bodrug from London, Ontario, Canada, showed us his creation. Starting with a stock Kyosho Burns, Don chopped, welded and machined until the wee hours of the morning to finish this twin-engine monster.

The car has many of the original features, such as the shaft drive, bevel-gear differentials, aluminum-plate chassis and



disc brake, and it now has two powerful O.S. EX-B nitro-burning engines!

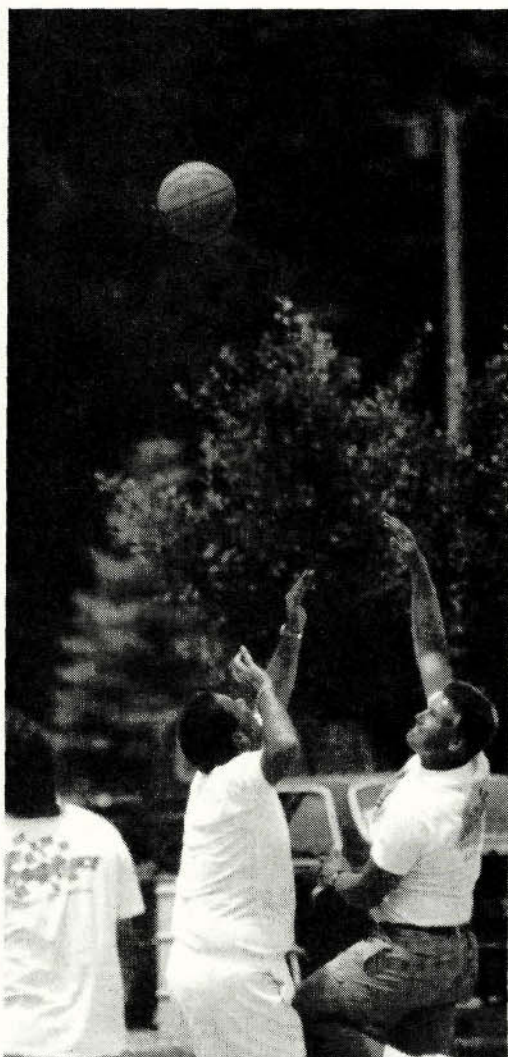
We didn't see Don's car in action, because he didn't have time to install the radio gear before coming to the States, but it was one of those cars we just had to show ya!

the 4WD heats and the Invitational exhibition.

At the end of the day, the 2WD Class had Timothy Motin with a 9-lap, 4:29.68 run, followed by Tim Richie with the only other 9-lap run of the weekend at 4:35.01. In the 4WD Class, Mike Boekdrukker and Scott Williams were the only members of the 9-lap club, with a 4:27.60 and a 4:31.72, respectively, both pulled off in the second round of qualifying.

The Invitational exhibition drivers included Rick Howhart, Tony Neisinger, Mike Blackstock, Darren Stump, Mike Burnette, Bill Jeric, Bud Bartos,

Joe Lawrence, Joel Johnson and Rick Hohwart. During the first day, Hohwart jumped to a commanding lead with three straight wins and a slow fourth heat. (The Invitational drivers ran both 2WD and 4WD.)



Right: During off-time, Joel Johnson showed Ernie Provetti and Rick Hohwart his "Magic" prowess on the basketball court.



With his modified Kyosho Lazer, Bill Jeric leads the Invitational 4WD heat through the first turn.

Dave Meredith, who lost his position to Stephen Koo who, in the final round, squeaked in by just over 2/10 of a second. After the Invitational heat, the track was again groomed for the Mains.

Race Director John

Thawley got the

program rolling at about midday. Starting with the lower Mains, both classes ran up through the B-Main, but the A-Mains were saved for the last two heats.

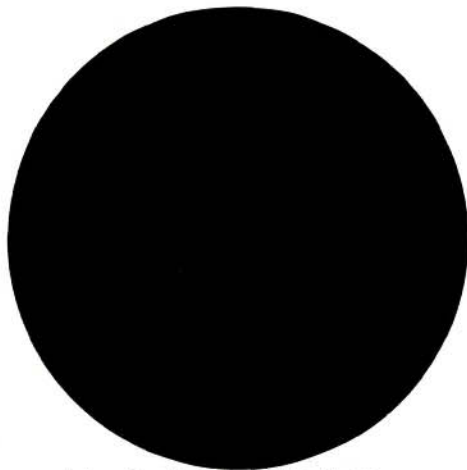
The A-Mains started with the 2WD Class; Joe Kolp took the top honors and was followed by Tim Richie and Pat

DAY 3

SUNDAY, JULY 8: the final round of qualifying was scheduled for before the Mains. In the 2WD Class, the top 10 drivers managed to stay in the A-Main with just a little position swapping at the close of the final round. The 4WD Class results were almost the same—with the exception of



The starting grid at the Freedom Hills track points the cars down the longest section.



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SPORTSMAN'S CUP

McCreery. It was a close race! Nine of the 10 cars were on the lead lap, and the first five cars were within 6 seconds of one another, but none managed to break into 9-lap territory. In fact, D-Main driver Ed Meyer managed to turn in the fastest run of the event! (unfortunately, a little too late!).

Third-place qualifier Greg Baumel took top honors in the 4WD A-Main. Speeding from the starting line, he set the track on fire, but he faced some tough competition. TQ Mike Boekdrukker was soon in a lead swap with Baumel, while 5th qualifier Paul Morack was close behind. When the dust settled, Baumel had taken the checkered flag only 1/2 a second ahead of Boekdrukker. The top four cars managed to do better than the fastest qualifying time and were separated by only 3 seconds at the finish line.

The close of the Invitational Class saw Rick Hohwart taking a decisive victory over Darren Stump and Mike Blackstock (up-and-comers who did surprisingly well against well-known topnotch drivers). In the 1/8-Scale Class, Joel Johnson took the overall win with Bud Bartos nipping at his wheels, followed by Mike Burnette for an easy 3rd.

As you'd expect during a national event, competition was close, and racers were serious about driving to the best of their abilities. Unfortunately, not everyone lived up to our expectations, but that's racing! Despite the importance of the competition, the atmosphere was calm, and that's always appreciated. There was no tension; racers were there to have a good time and do they best they could; and they were able to learn from the Invitational drivers—in the pits, or at one of the seminars. I'm sure every driver went away with *something*—if not a trophy, then a wealth of new information about racing.

Thanks to the Invitational drivers who took time out of their holiday weekend to attend, and congratulations to all the good sports who raced and, of course, to the winners!

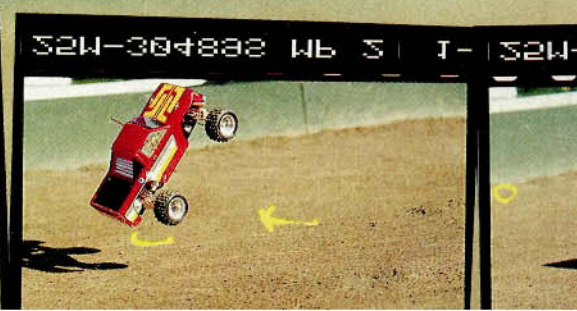
TRACK REPORT

T R A X X

DANGEROUS TYPE!

TRAX-TEAC

FOR ALMOST two years, I've been rumbling that everyone should keep an eye on Traxxas*, and approximately nine months ago, I saw an unnamed Traxxas racing truck





PHOTOS BY WALTER SIDAS

LE

at the
Philadel-
phia Hobby



by CHRIS CHIANELLI

Show. I must have returned to the company's booth at least a dozen times to fiddle with its long travel and

smoothly damped suspension.

I may not be the hottest trigger around, but I know a winner when I see one!





A lot of people laughed at me for taking Traxxas seriously, and it might sound as if I'm patting myself on the back now and saying, "I told you so." So what if I am?! Like it or not, a new name

is showing up on winners' charts. Traxxas' new racing truck—the TRX-T Eagle—handles so smoothly, it makes even *me* look like a pro driver!

During the performance

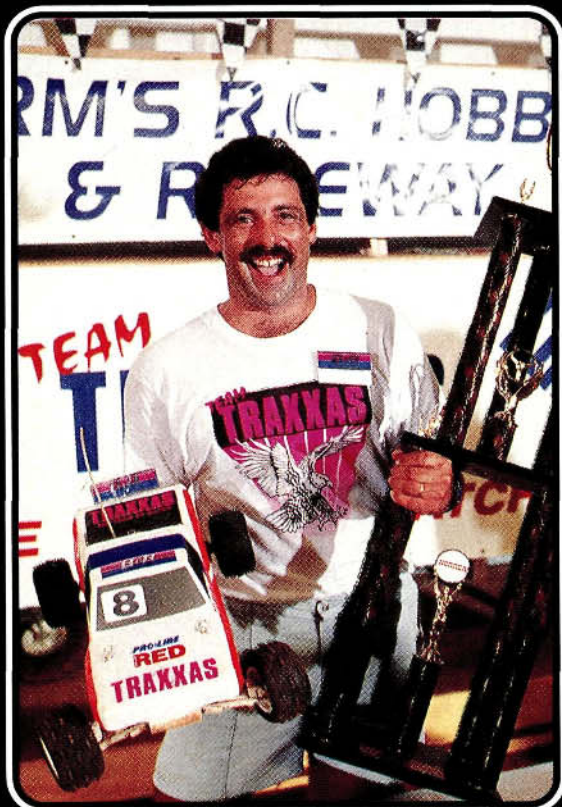
testing, *R/C Car Action* staff members John Huber and Alex Strouthopoulos (both avid racers) were very impressed by the Eagle. Steve Pond has yet to drive it, but he often fiddles with its suspen-

DALLAS DEBUT

The crowd was so enthusiastic that, at times, their cheers drowned out the voice of the announcer. Where?—at the NORRCA National Off-Road Championships on July 6, 7 and 8 in Dallas, TX. The cause of the excitement?—the battle between Tom Owens and Joel Johnson. Driving the only Traxxas TRX-T Eagle in the A-Main, Owens battled his way from 8th place (in a field of nine), and respected world-class driver, Johnson was his biggest threat. Driving a JR-XT, Johnson was the day's TQ.

Owens and Johnson exchanged the lead more than once, but at the halfway mark, with his Eagle in 4th, Owens slowed and allowed Johnson to pass! He had mistaken Johnson's car for one belonging to another driver! Realizing his error, he promptly accelerated to catch Johnson in the infield, and he then moved to the front of the pack. The crowd went berserk! Then, thinking he still had another lap to go, Owens went on driving and failed to notice the buzzer that had given Traxxas its first ever national title. Was that boy focused, or what?!

Praising the Eagle's ability to survive the rugged course, Owens said, "Only finishers win. If the car doesn't last, speed and driving don't mean a thing." In subsequent 2W Open races, he placed well, so the future of Team Traxxas and its cars looks promising!



TRAXXAS TRX-T EAGLE

Type Off-road racing truck
Scale 1/10
Sug. Retail Price \$330

DIMENSIONS:

Overall Length 17.25 inches
Width 12.375 inches
Wheelbase 10.875 inches
Front Track 10 inches
Rear Track 10.25 inches

WEIGHT:

Gross (w/bat.) 3 pounds, 14 ounces

BODY:

Type Chevy S-10
Material Polycarbonate

CHASSIS:

Type Narrow pan
Material Pressure-molded graphite

DRIVE TRAIN:

Primary Pinion/spur
Transmission Gear drive
Differential Ball diff
Bearings/Bushings Ball bearings

SUSPENSION:

Type (f/r) Lower A-arms, upper control links
Dampening (f/r) Aluminum, oil-filled, coil-over shocks

WHEELS:

Front: Type One-piece nylon (offset)
Dimensions (DxW) 2.2x2 inches
Rear: Type One-piece nylon
Dimensions (DxW) 2.2x2 inches

TIRES:

Front/rear Truck pin-spikes

ELECTRICS:

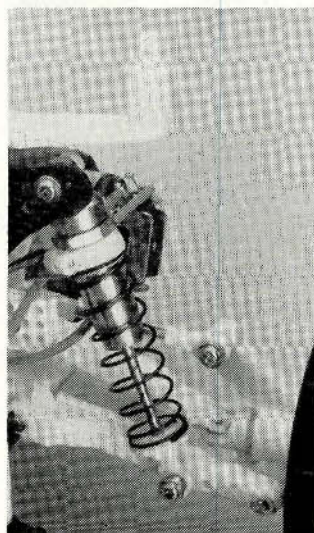
Motor Not included
Battery Not included
Speed Controller Not included

OPTIONS AS TESTED:

B&R 15-turn, double-wind, modified motor; Tekin 411P electronic speed controller; Traxxas extra-soft, long, front springs; Team Losi synthetic shock oil (front 20WT, rear 30WT); Futaba Magnum Jr. radio.

COMMENTS:

With most of the necessary "hot" hardware included, the TRX-T is very competitive out of the box. It's easy to build and is unlikely to require much maintenance. The Eagle handles smoothly and lands well after jumps; you really have to work to make this car spin out or flip over! The manufacturer should upgrade the poorly tempered E-clips and include chassis side dams. We're not convinced a direct steering linkage is the way to go for an off-road truck, but it does have a positive feel.



Front view of rear suspension shows the multiple shock and upper-link mounting options.

sion, just as I did! Steve is cautious and always reserves judgment; it's nutcases like me who stick their necks out and risk looking like fools!

A TRUCK FROM THE GROUND UP

Unlike conversions, the Eagle was designed as an off-road racing truck from the ground up. I won't say that it's *better* than other racing trucks—at least, not yet!—but I feel quite comfortable saying it's as good as the very best.

The TRX-T comes with all the goods needed to kick serious "you know what." Take the chassis; it's not sawn from stock sheet graphite (which is why most graphite chassis are flat slabs); instead, it's made of a high-pressure molded graphite, so the front caster angle can be molded-in (like as it is on the RC10 aluminum chassis). The longitudinal up-turns are also molded into the sides' edges, and this results in

(Continued on page 72)

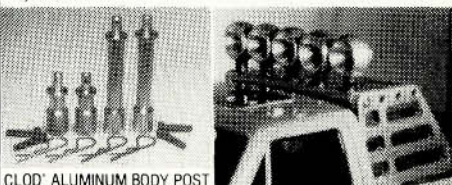
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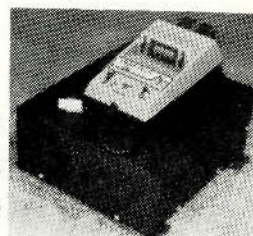
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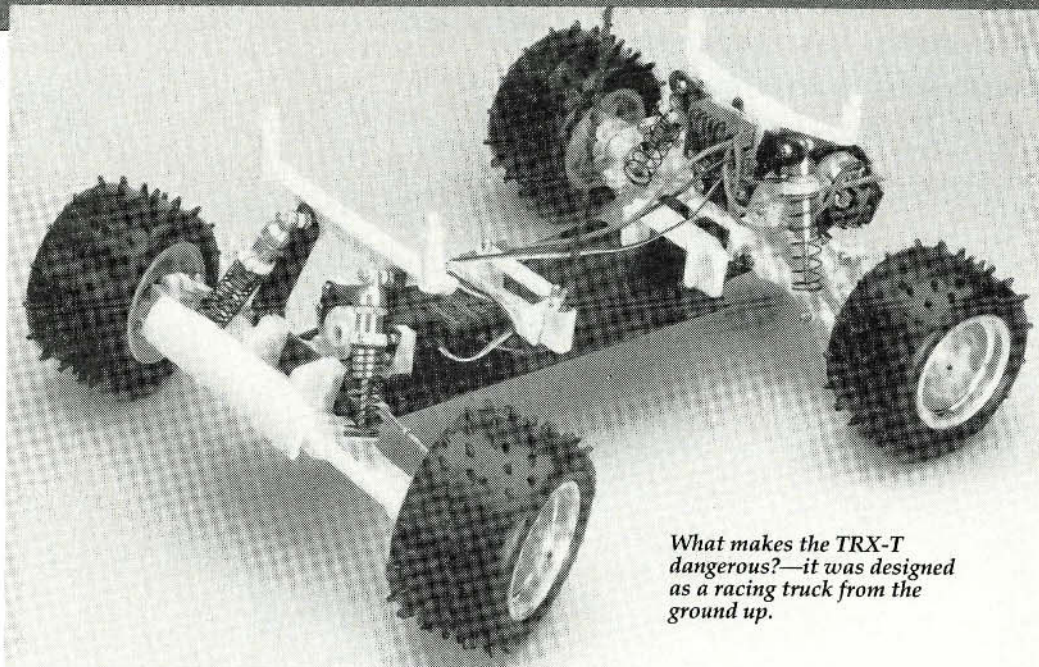
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TRX-T EAGLE



What makes the TRX-T dangerous?—it was designed as a racing truck from the ground up.

fantastic rigidity.

The ball diff has an ingenious locking feature. You don't have to remove a half-shaft with this setup; just slip a thin Allen wrench through a hole in the top of the gear case, and you can make trackside adjustments in 30 to 60 seconds! The A-arms are long nylon units; turnbuckles and ball bearings are used everywhere; and the long, gold-anodized aluminum shocks are adjustable and smooth. They're bolted to tall graphite towers and don't seem to leak.

I made only minor changes to my Eagle. Instead of the included oil, I use Associated* synthetic shock oil (20WT in front and 30WT in the rear). I also use softer front springs to take full advantage of the long front suspension throw. I'm told Traxxas will

include similar units in future kits, but Trinity* and Associated offer long soft springs that work well.

The supplied pinion stinks when compared to the rest of the kit, so I replaced it with Team Losi* pinions. All gears are 48 pitch. The Chevy body is made of a good, thinly extruded polycarbonate, but it seemed mediocre in terms of scale detail, and I prefer Ford's anyway. The aluminum-like, one-piece, lightweight wheels score high in the beauty department, though.

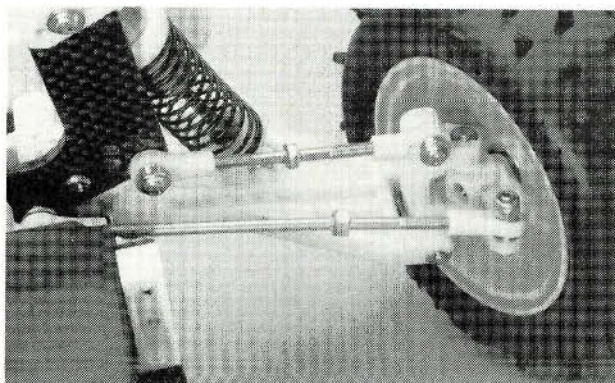
A WARBIRO IS HATCHED

Traxxas has kept the TRX-T simple, because simple designs not only seem to run better and break down less, but they're also easier to build. Shock assembly is probably the most time-consuming step in building the Eagle, but

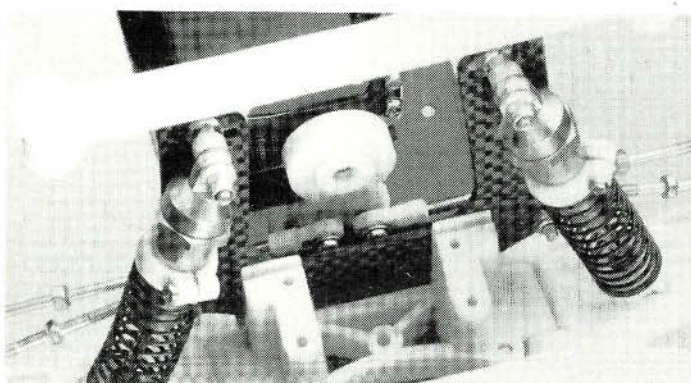
it's not complex. The shocks come with air diaphragms and different pistons (I used the single-slot one), and they're sealed with double O-rings. The finished units have lots of travel and work smoothly.

I do have one complaint. Although the E-clips fit well, they're poorly tempered and bend easily. They're standard size, so why not spend a few pennies on a box of better ones?! On the plus side, the diff comes assembled, and the included servo-saver looks substantial; this is good, because the steering is direct drive off the servo, and it needs the protection. I'm still not convinced that a direct-drive steering system can survive off-road truck-racing conditions, but time will tell.

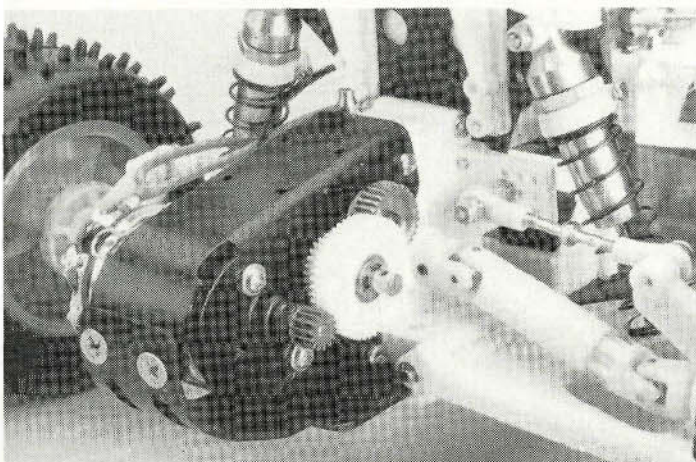
I had no real problems building the truck, but do me and yourself



Turnbuckles and aircraft nuts are supplied for all locations. The front suspension travel is 2½ inches. Note the graphite shock tower.



The supplied heavy-duty servo-saver looks as if it will cushion shocks caused by the direct-drive steering, but only time will tell.



All gears are 48 pitch. A Team Losi pinion replaces the inferior stock unit. Telescopic half-shafts are a welcome sight on the rear suspension, which has 2 1/8 inches of travel.

a favor: read and follow the directions! The instruction booklet is extensive; it has tons of photos, diagrams and coded numbers that coincide with marked parts bags. At the bottom of each page, the screw, nuts and/or bolts to be used are shown in full size. If you're in a hurry to go racing, with a concentrated effort, you can build the Eagle in one evening.

Because the truck doesn't come with a motor, I installed a B&R* 15-turn double-wind—the same motor that Tom Owens used to win the NORRCA Nats in Dallas. (Look for "Project Strike Eagle" soon, in which I reveal all the hop-ups that Owens used on his TRX-T—from rubber to shock oil!) I finished my Eagle with Coverite's* new paint and trim sheets. I hope Coverite comes out with more radical colors, because the paint really goes on well. My ready-to-race Eagle weighed a lean 3 pounds, 14 ounces with battery.

HAVE DIRT, WILL CLAW

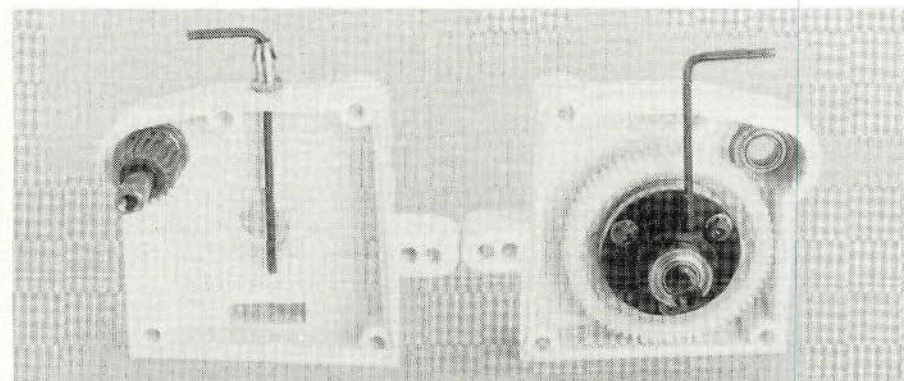
Ever hear the expression "stick like

Car Action offices! I quickly dialed-in the truck to produce the slight understeer I like. Its pin-spoke tires ran fairly true (although I've seen better), and they worked well on the loose, high-bite surface at Wasteland Raceway. The Eagle is so smooth and balanced that you immediately feel confident at the controls, and I can't remember spinning out once during the entire photo session!

Every time someone new tried the Eagle, they barely completed a lap before exclaiming, "This thing is awesome," or "It's so positive!" John, Alex and a few others were very impressed by the truck's handling and decided to buy one; in fact, Alex was so upset at the thought of spending another day without a TRX-T that he paid overnight freight charges!

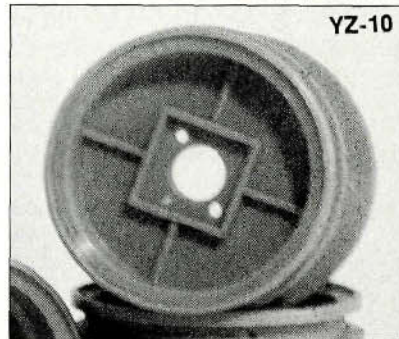
With the good damping and the ample suspension travel (2 1/2 inches in front, 2 1/8 in the rear), jumping and landing this racer was like breathing in and out—even when it was "crossed up." The truck touched down without bouncing—as if a vac-

(Continued on page 154)



Using an Allen key in this clever diff lock-off makes trackside ball-diff adjustments a breeze.

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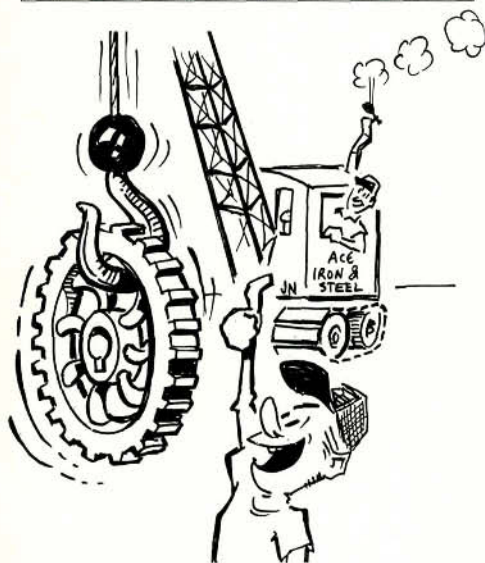
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TROUBLESHOOTING

by STEVE POND

We've persuaded veteran illustrator Jim Newman to lend his talents to this column. He has been illustrating Radio Control Car Action's "Pit Tips" ever since the magazine started, and he has contributed regularly to one of our other publications—Model Airplane News—for more than 20 years! We love his work, and we're sure you will, too.

If you have a technical problem that your hobby shop or racing friends can't solve, give us a shout at Radio Control Car Action, and we'll see if we can find an answer. Questions should be technical and should be addressed to Troubleshooting, c/o Radio Control Car Action, 251 Danbury Rd., Wilton, CT 06897.



GO FAST

I was given a Turbo Optima Mid SE and, like all racers, I wanted it to go fast. To do this, I installed a behemoth sprint motor, but after three months, my ball differential and counter gear were so stripped that they both looked like bearings. I asked the owner of a hobby shop if I could get steel gears. (My top gear was already steel, so I didn't think new ones would be a problem.) They had a steel counter gear in stock, so I bought it, and I asked them to order a steel gear for my ball diff. A few weeks later, I was told that Kyosho doesn't make a steel ball diff gear. Why? Two out of three of the gears, Kyosho makes in steel. Would it kill them to make the other of steel? Please help me, Steve!

Dennis Gray
New Lenox, IL

My experience with the Optima Series cars is that they have always had a problem with their final pinion and counter gears stripping. The shaft the counter gear rides on is supported by plastic on either side of the transmission housing. Whether you use bearings or bushings, the shaft can spin. At high speeds, it spins so fast that it starts to melt the plastic that supports it. When the plastic melts, proper gear mesh goes out the window, and the gears are damaged. It's a design flaw, and paying close attention to it is the only solution.

I recommend that you use ball bearings on the counter gear and keep them very clean. Robinson Racing offers an aluminum counter gear, and Thorp offers a steel final pinion, both of which help avoid transmission damage, but I'm not convinced that a solid steel transmission is the way to go. Try using just the aluminum counter gear, and keep a close eye on the bearings.

To answer your last question: I don't think you need a steel diff gear. The nylon gears absorb some of the motor vibration, and this goes a long way to prevent premature wear. I've had far fewer problems when using only the aluminum gear.



CZ NOT SO EZ

First, your magazine is the best on the subject. I'd like to see more on gas-powered cars though, and that brings me to the subject of my letter.

I have a Kyosho Stinger with a CZ-2 engine and a CZ-R carb, but the connecting rods break. I had no problems before

I changed the carb. Could the new carb be the problem? Is it getting too much fuel for it to compress? When I disassemble the engine, not only is the lower end of the rod broken, but it's also bent severely, and the bottom edge of the piston is chipped out. Despite a careful break-in period, this has happened twice. Any advice?

Paul Schwartz
Clifton, NJ

The CZ engines are famous for blowing their connecting rods, so no matter how you break-in your engine, there's a risk that the rod may let go. I don't know of any after-market rods for the CZ engine, but if this continues to be a problem, I imagine some manufacturer will eventually come up with a stronger rod.

The new carb shouldn't be a problem but be careful to avoid running the engine up to speed under a no-load condition (i.e. off the ground) and over-revving it on long straightaways. Of course, if you wanted to, you could run the engine wildly and keep replacing rods!



TAMIYA TORTURE

I need help! In my Tamiya Blackfoot, I installed a Thorp Dirt Burner differential with telescopic drive shafts. I tighten the tension screw on the differential, but after 2 to 4 minutes, the screw always loosens, and the rear end spins freely, but the truck doesn't move.

The dealer who sold me the Thorp Diff said the tension spring (really three convex washers) and was ruined, so I bought new washers and a new screw, which was slightly bent on the end. I asked why the

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Illustrations by JIM NEWMAN



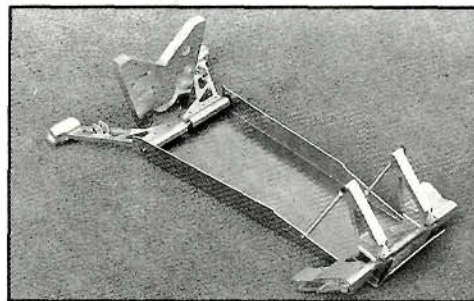
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BURNED UP

I recently converted my RC10 into a monster truck, and I have a real problem: every time I run it, it burns out a motor. The workers at my local track said my gear mesh was wrong, so they fixed me up with a 9-tooth pinion and a 60-tooth spur gear, but it still burns out my motor. Even after the gear changes, the racers at the track don't know what the cause of the problem could be. One thought my transmission was messed up, but when I put it back into the car, it worked fine, and didn't burn out the motors.

I have a Novak T-4 electronic speed

(Continued on page 76)

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TROUBLESHOOTING

controller, a stock motor and tranny, a 6-cell battery, a Litesink (to cure the overheating that I *hoped* was burning out the motor—it didn't help!), Blackfoot tires and Blackfoot rims. I hope you can help me, because buying new motors is expensive, and I've burned out four in a month. Please help!

Kirk Leven
Walnut Creek, CA

First, take the motor out of your car and see how smoothly the transmission operates. If the tranny doesn't spin easily for more than 5 seconds, it's the cause of your problem. Disassemble it and reassemble it according to the instructions, making sure that there's very little drag. Improper gear mesh could also be causing a problem, but to smoke that many motors, it would have to be preeety bad! The ratio you're running is in the ballpark, so I can't think of any other cause.

Take the rear of the car/truck apart and start from scratch. Make sure that all the components are assembled properly and causing as little drag as possible.



WHAT HURT THIS CAR?

I own a totally stock Kyosho Turbo Optima Mid SE and a Kyosho 7-cell Turbo Racing pack. When I first ran the car, everything was OK, but by the time the battery ran out, the resistors were smoking, and the battery connector was so hot that it started to melt (I had to pry it apart with a screwdriver). When I tried to run it again, it only worked on the third speed. I took apart the speed controller, cleaned it and noticed that it now had a little hole burned into it. I checked everything in the controller and made sure everything was screwed together tightly, but it still didn't work.

I ordered another Kyosho rotary speed controller and some grease. Everything then worked fine, but after the first run, the resistors smoked again. After one more run, my battery pack stopped working! (I had about a 1-minute run each time.) When I hooked the battery up to my car, nothing happened. I borrowed my

friend's 6-cell battery pack and was able to run my car about seven times, and each time, the resistors were only slightly warm.

Then the speed controller stopped working! I took it apart and made sure it was clean and screwed together tightly, but it still only worked on the fastest speed. I left the car for a minute, returned to make sure that I had turned off my radio, and I saw that I had left my car on. My resistors were so hot that they glowed, and the wires around them had melted! My battery connector was also hot again, but I was able to get it apart without a screwdriver, although it had melted a little.

I still owe my parents a lot of money for the car, so I can't buy an electronic speed controller, and I'm also afraid what would happen if I got one. I've checked the car completely, and it's hooked up correctly. I use it on a dirt track, and I never do anything that would hurt it, so I don't know what could be wrong. I also own a Pro-tech 700 charger with a digital voltmeter. When I have an 8.4V battery hooked up, it says anything from 9.45 to 11.46 volts, and when I have a 7.2V battery hooked up, it says anything from 8.4 to 9.46 volts. I don't know whether that could be what damaged my car, so I hope that you can help me.

Brian Vander Vort
Vancouver, WA

The solution to your problem is anyone's guess! These types of electrical problems are tough to solve without seeing the car, but I'll give it a shot.

First, be sure that all the electrical gear is assembled properly and that exposed wires don't touch one another or the chassis. The speed controller should be properly lubricated with a light film of electrical grease. Don't run the car at low speeds for a long time, because the resistors will get extremely hot. Also, when the battery is dumped, be careful that your car doesn't get jammed against anything while the throttle is in forward or reverse. When the battery is discharged so much that the radio doesn't work, the throttle can get stuck in the "on" position. There's still some juice left in the battery, and this will cause the resistors to heat up, too. If you're sure you've eliminated all possible electrical problems, check the drive train to ensure that nothing is binding.

If you still have a problem, it's time to take your car to a qualified hobby shop so that a pro can look at it.



ASSAULT ASSISTANCE PLEASE

About two years ago, I bought an Assault gas-powered car, and I've had several problems: when I first got it, it ran fairly well, but then it went downhill. I sent it to Hobby Services in Illinois to have it checked out, and they said everything was all right. No matter what octane of nitromethane hobby fuel I use, the car will run for a few feet or yards and then die. They say nothing is wrong, but I don't know how they figured that out when they spent only .04 minute on it during the three times I sent it to them. Do I have to raise the tank, or what should I do?

Mark Anderson
Seattle, WA

Check that there's proper pressure supplied to the fuel tank. Without pressure, the carburetor will be sucking air, and this can cause the engine to stall. Pressure is supplied to the fuel tank by means of a rubber hose that runs between it and the muffler. Stalling can also be caused by a poor air-to-fuel ratio. If the engine stalls when it's cold and you're coming on the throttle, it's probably lean (too much air in the fuel). Start by turning the mixture needle gradually counterclockwise—1/8 of a turn each time. Run the engine for a minute, then check the temperature by dripping water onto the head. If it boils off immediately, the engine is still running too lean and you must keep turning the needle counterclockwise. (Under these circumstances, don't run the engine too long before enriching the mixture, because overheating could result.) If the water bubbles when it hits the head, the temperature is just about right. If it doesn't, the engine is getting too much fuel and the mixture should be leaned out slightly (turn the needle clockwise). ■

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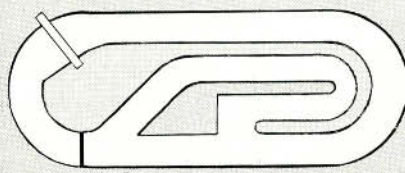
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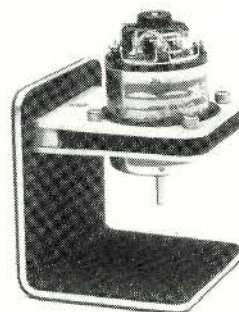
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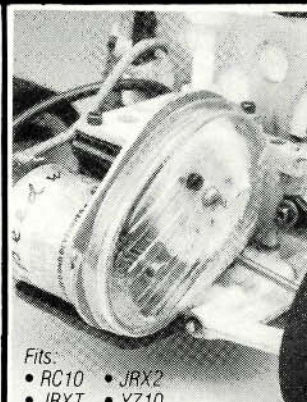
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LYNX II SPORT

(Continued from page 34)

paint to replicate the design on the full-size car. Then, I called Custom R/C Graphics* to order some Nissan and Calsonic graphics. (I'll be doing a feature on this company's graphics.)

TEST TIME

It was time for a test drive, so Editor Steve Pond and I headed to Bedford Hills Super Speedway, which is an indoor concrete oval. This was the first time I had driven with capped tires on a concrete track. (I usually race on carpet.) These tires take some getting used to, as they must be warmed before they'll bite.

The Lynx II was a little touchy on the straights, but that was because of its fast steering servo. The track rises and drops before the first banked turn, and we used this to our advantage. We went fast into the turn, cut the wheel and sent the car into a very controlled sideways slide to set it up perfectly for the straight. It took

(Continued on page 90)



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C O N V E R S I O N

Madcap Truck

by BILL O'BRIEN



HERE I GO AGAIN!

I've been playing with my Tamiya* Madcap beginners' 2WD car for a few weeks, and I'm already planning a conversion. I own a Turbo Ultima, a Top Cat and an RC10, so I don't need another upscale 2WD car. I've wanted to modify my King Cab...and the King Cab and the Madcap have a similar chassis design.... Hmmm. What if I convert the Madcap into a

truck and call it the MadCab? That sounds crazy enough to actually work!

THE KIT

For all you reluctant model modifiers, I have good news and bad news about the kit. The good news is that there isn't a Madcap conversion kit, yet. All of my parts were spares and leftovers from other projects. The bad news is that all of these parts are readily available, so there's *no ex-*

cuse for not converting your Madcap, too (and convert it back in about 12 minutes)!

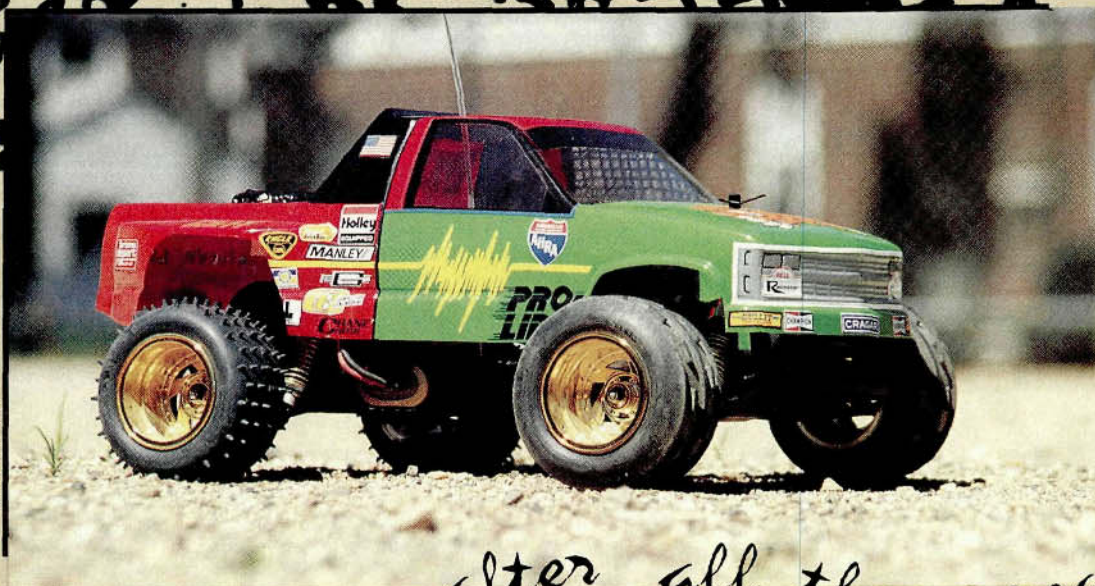
PARTS, PARTS, PARTS...

The list of what you'll need is simple. Originally intended for the RC10 truck conversion, the rear body mount is by Pro-Line*. The front mount is a 3.5-inch Bolink* body post. Lunch Box steering blocks and axles should work on the conversion, but the

Lunch Box pail at my hobby shop was empty, so I improvised with RC10 steering blocks and Pro-Line's extended RC10 front axles. I think that CRP* makes a Tamiya-to-RC10 conversion axle, too. You can use either setup to mount King Cab front wheels.

I replaced the stock spring dampers with Kyosho* long Platinum shocks on the rear and short Trinity* Purple Power shocks up front. Kyosho's platinum shocks are the best-kept truck shock-absorber secret! (Two years ago, I named Kyosho's LeMans 360ST as the best-kept truck-motor secret, but some of you didn't listen. These motors are now sold as the Mega Truck motors!) Take my word for it, even though many racers complain about the time it takes to adjust them, the Platinum shocks are good truck shocks! (Or don't take my word for it, but I bet you'll buy them when

(Continued on page 83)



still crazy after all these gears



they come back as Mega Truck Shocks, or some other silly name!)

Finding tires was easy, because Pro-Line has a dynamite selection that fits 2.2-inch rims. Because the MadCap is a 2WD truck, I used a set of spiked, small-paddle centers on the rear and serrated, grooved fronts (the front tires many JR-XTs use in competition!). Rims were another matter. I had left-over Pro-Line Monster Truck rims for a Kyosho truck, and they looked as if they would fit the hex-drive logs at the rear of the Madcap, but I couldn't mount them correctly. I chose Imex* gold-plated California-spoke King Cab wheels.

Finding a motor was simple. I always have several 360STs lying around, so out came the 540S and in went a 360ST. I kept the stock pinion, spur combination and mechanical speed controller. Believe it or not, the stock speed controller can handle the increased amp draw that larger tires create.

Now I had to make this conversion look like a racing truck! I had an

extra Pro-Line Chevy Stepside body but, if I had to buy a body, I'd have

chosen a slab-side pickup to avoid tire clearance problems. Slab sides don't have protruding fender wells that will be smacked by the tire spikes when the suspension compresses. Pro-Line makes a Nissan truck body that's similar to the King Cab's, but much more affordable.

GET IT TOGETHER!

Although all the components used on the King Cab's front end are available and cost about \$35, they aren't compatible with the Madcap. Mounting the entire front assembly onto the Madcap would be a nightmare of cutting, drilling and trimming.

To fit the front shocks into the A-arms, remove the blue shock ends and spring caps from the stock spring dampers, and install them on the Trinity Power shocks. Use the stock brass

inserts and mounting screws, but mount the shock on the *last* hole on the outside of the A-arms—not in the center hole, which is the stock location.

Short shocks should work fine because the Madcap and its off-spring, the Mad-Cab, have a 1-inch-long suspension travel. Depending on the track you use, you may want more suspension travel. If so, use the upper shock-

mounting hole and the upper suspension-rod mounting hole to add an extension to the shock tower so you can mount long shocks. Don't add too much travel, or the chassis will bottom-out before the shocks! Try adjusting the spring tension before you go long and lanky. Remove

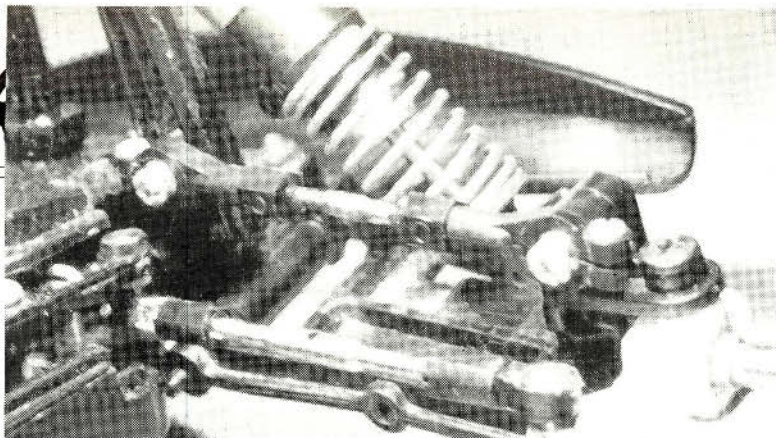
the two self-tapping screws and the machine screw and nut that hold the cap down on the steering bellcrank, and remove the two screws holding the short, stubby front body post. Remove the steering rods and the upper suspension rods.

On the Madcap, they're adequate, but on the *MadCap*, they're junk! To replace the stock kingpin screws on the suspension rods, hunt up eight 3mm ball links and

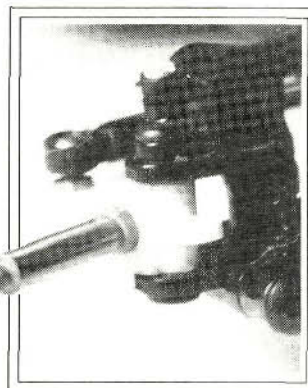
two 3mm nuts. (Hobby shops should have them as part of either a Tamiya or Kyosho spare parts kit, and Hobby Lobby* sells them, too.) Finally, remove the steering blocks and axles, but save the kingpins from the steering blocks.

To put everything together, use four Du-Bro* 4-40 turnbuckles, four Blackfoot rod ends and four Du-Bro 4-40 E-Zlinks. Trim the turnbuckles, and install the 3mm ball links into the

(Continued on page 98)

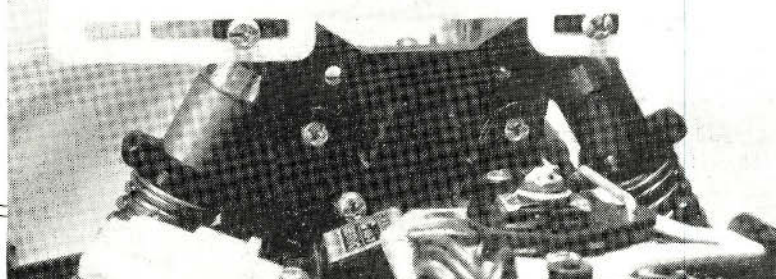


There's a variety of steering rods to choose from, including normal turnbuckles, titanium turnbuckles and stock threaded rods. Your wallet will determine which is best for you, but adjustable turnbuckles are best for the truck!



After trimming them, the RC10 steering blocks fit right in. The axles slip into the blocks, and the 3mm E-clips hold them in place from the rear.

The Pro-Line RC10 truck-body mount was nearly a perfect fit for the Mad Cap chassis. To center it correctly, I used a hobby knife to remove a small divider from the end holes.



H O U G E

RC10

CONVERSION

by MIKE LEE

TRAILING-ARM TERROR

WE ALL KNOW that a racing chassis won't stay the same forever—not in full-scale racing and not in R/C. There are many reasons for this, but, for the most part, a driver's style or preference will determine whether or not a stock chassis will be modified.

With this in mind, I'll look at what modifying the chassis can do for a car that already runs well. I compared the Associated* RC10 off-road car with a highly modified RC10 that has parts and a chassis pan from Houge Enterprises*.

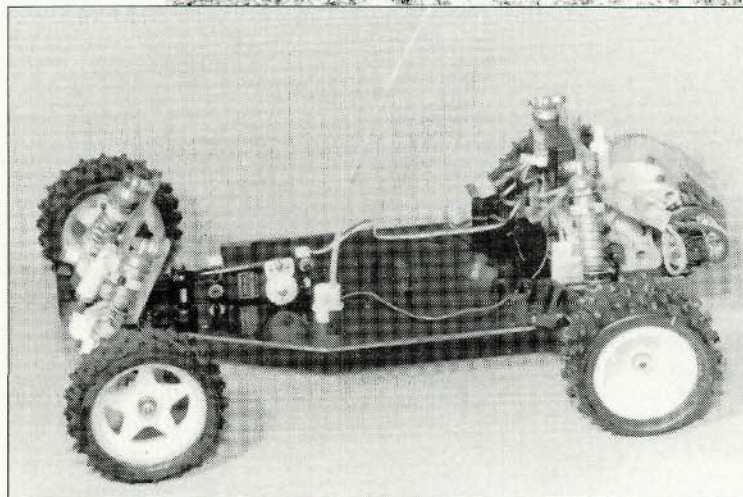
AN RC10 FAN

The RC10 is famous as a fast, tough, dirt buggy. It has been voted the off-road 2WD Car of the Year, and it's still one of the top vehicles to beat in the dirt. My experience with the RC10 dates back to the first kits. I reviewed it for Model Airplane News (before Car Action was born) and, because of its dependability, I haven't been without one since! I'm a firm believer in the RC10.

When the Ayatollah asked me to make this comparison, I cringed. One of my RC10s would have to be "mutated," and I resisted—but, a test is a test.

THE HOUGE CHASSIS

Made for the RC10, the Houge chassis pan no. 160 is composed of 1/8-inch-thick (.125) graphite. The pan is very rigid, and like

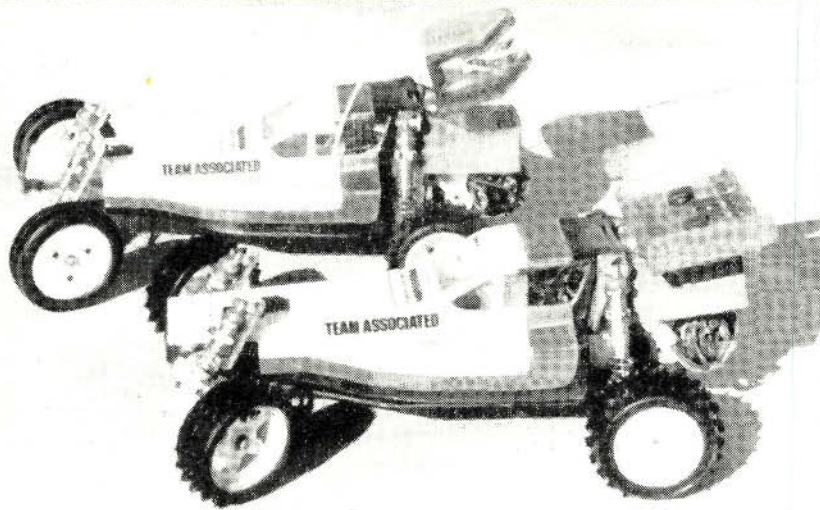


The completed, ready-to-roll conversion car with a Houge chassis, trailing arms and steering bellcranks; Andy's R/C front A-arms; Associated TQ-70 front tires; Losi X-pattern rear tires; a Futaba radio; and a Tekin speed controller. It weighs 4 ounces less than the stock car.

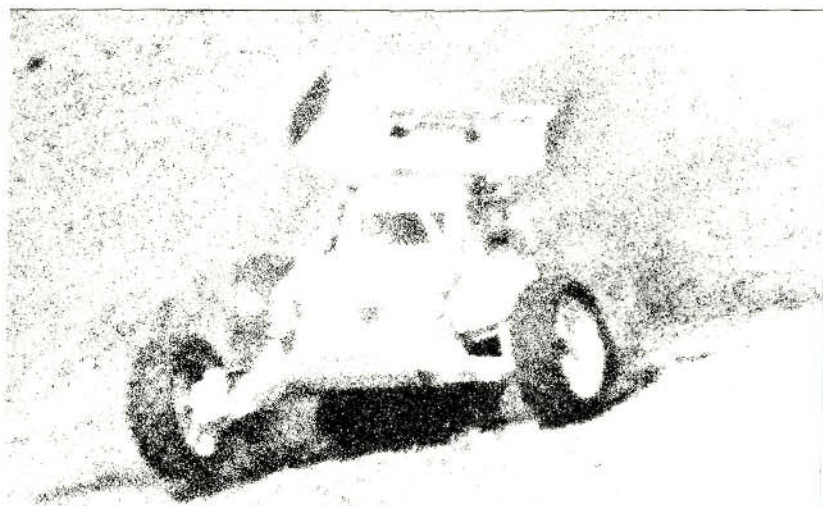
the stock aluminum chassis, it features a 20-degree front kick-up. It's pre-drilled for all the stock chassis' main components,

including the battery-pack trays. The tray's placement enables the battery pack to run from the front to the back of the chassis, rather than across it like the stock unit. All the holes were clean and accurately drilled.

I don't like the graphite on the Houge chassis. It chips and frays easily when you drill into the chassis to mount something.



A side-by-side look at the two cars. The Associated Pro-Tech II body is great looking, and it handles well, too. While the stock RC-10 sports a kit wing, the Houge conversion car has a Hot Trick Racing titanium wing.



bellcranks ensures smoothness and provides exceptional load bearing in case of a hard hit. With these units in place, the standard servo-saver on the steering servo absorbs the rest of the shock.

CONVERSIONS

Our sacrificial car was a well-used, two-year-old RC10. The Houge conversion took about 90 minutes to complete—the radio and speed controller installation took one third of the time. I also installed a set of Andy's R/C* long A-arms to the front end, Associated TQ-10 rims on all four corners, TQ-70 tires in the front and Losi* X-pattern rear tires.

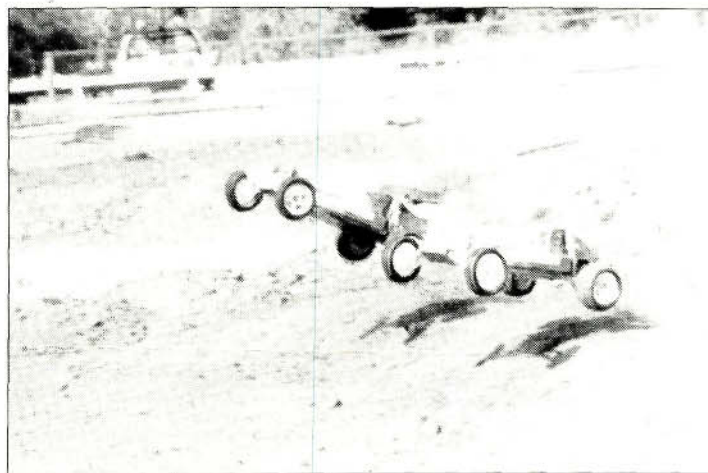
CHAMPIONSHIP EDITION

The stock car is one of Associated's latest aluminum chassis cars: the Championship Edition RC10. It features long front A-arms, new shock towers, long front shocks, new rear-wheel carriers with 3 degrees of toe-in, turnbuckle links all around and new idler gears in the tranny. These improvements practically give you the aluminum version of the graphite RC10!

My CE RC10 also came with the new three-piece wheels with TQ-71 ribbed front tires and TQ-21 rear knobies. I opted to assemble the rear end with the maximum 3-degree toe-in. (The original RC10 only had 1 1/2 degrees.)

BODY & POWER

Both cars had the Associated Pro-Tech II body—a good-looker on any off-road vehicle! The



stock car came with a wing, while the test car sported a titanium wing from Hot Trick Racing Cars. (This company is no longer in business.) Both cars used Tekin* 600 Pro-XT speed controllers and micro receivers, Precision Motor Works* stock-class motors, Futaba* 131S servos and Kimbrough* servo-savers.

WEIGHT & SIZE

In their quest for the gold, many drivers try to make their race cars as light as possible. OK, that's cool—as long as the car doesn't dip below the class minimum-weight rules. The scales showed that the stock CER10 weighed 53 ounces (only 1 ounce over the ROAR limit). The Houge conversion car (with all that neat graphite stuff!) was 4 ounces lighter. Both weigh-ins were

When I mounted the antenna, I had to dress the hole with CA to prevent further chipping.

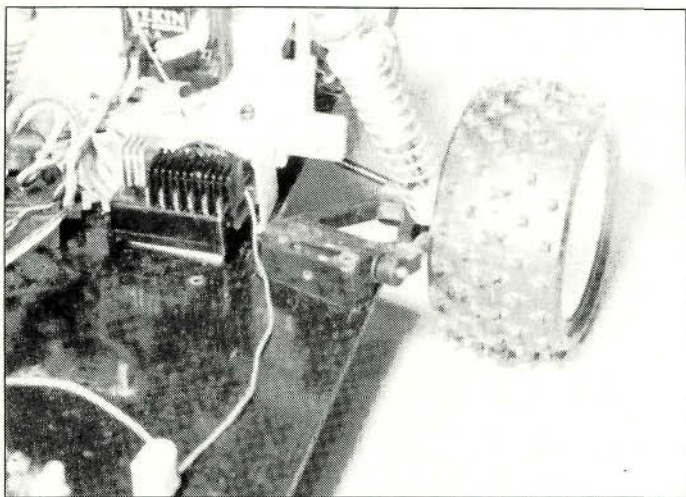
HOUGE TRAILING ARMS

Attached to the main chassis pan is the Houge Trailing Arm Kit (no. 155). It's a retrofit kit that replaces the stock A-arms with wishbone-type trailing arms and also has pivot mounts, swing pins and even new bolts. By the way, with the main chassis pan, you can use either the Houge trailing arms or the stock A-arms—take your pick!

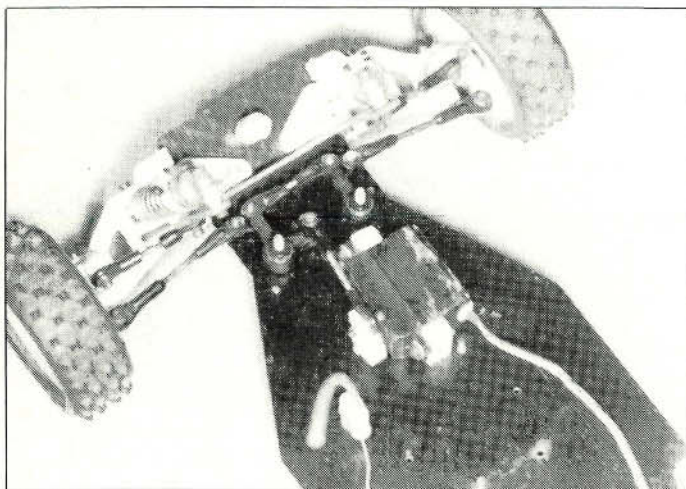
A Houge steering bellcrank kit replaces the kit steering arms. The stock units were made to augment the servo-saver, because they're flexible servo-saving devices as well. With this kit, experienced drivers can take advantage of a better steering setup.

The Houge bellcrank unit has two steering bellcranks that are ball-bearing mounted onto the stock RC10 bolts. One of the bellcranks has the steering link on it, and the whole assembly replaces the stock unit nicely. Adding ball bearings to the

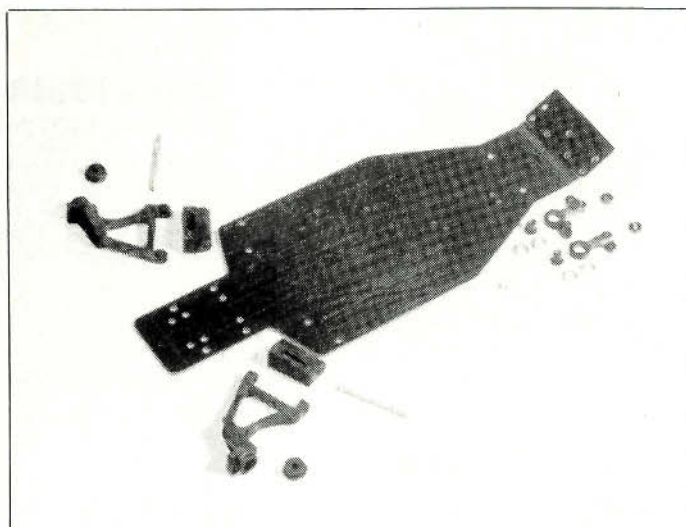
HOUGE RC10



The trailing arms are mounted on the Houge chassis. Note the angled pivot/mounting blocks that give the arms a proper swing angle. Unfortunately, unlike the stock RC10, the camber can't be adjusted.



The Houge bellcranks mounted to the Houge graphite chassis. It uses the same space as the stock RC10 steering bellcranks, yet it provides solid steering response.



Houge Enterprises' trailing-arm chassis with mounting blocks and a complete steering bellcrank kit. Note that the steering bellcranks are equipped with ball bearings.

done without the body and wings mounted to either car. A light body and a light coat of paint, however, only add an ounce, and the wing, a 1/2 ounce. In that case, the Houge conversion would be just shy of legal, while the stock car would be 2 to 3 ounces overweight.

Is the cost of a graphite chassis worth the weight savings? If you're driving in local races and not worried about Jammin' Jay and Racing Rick, then no, it isn't worth it! There are, however, other features on the test chassis to look at, so hang tight.

The Houge chassis was 1/4-inch shorter in the wheelbase than the stock chassis and exactly the same width, front and rear, at the wheels. It rides a little higher because it's lighter.

TRACK TEST

For the track test, I made sure that the two cars were comparably matched. I used a Futaba Magnum 2-channel for control (the standard R/C drivers' radio choice—nothing works like success!). The batteries were matched Sanyo* SCR packs, and the Pro-Comp Off-Road Stock motors were from Precision Motor Works. Dyno-testing revealed a high rpm motor with plenty of guts for off-road running. We'll see about performance.

The cars were track-tuned for gearing, suspension setup, steering setup and ride adjustment for both ground and air running. Air running? No track is complete without a couple of jumps! Once the tuning was complete, the testing began.

I've been driving an RC10 for more than four years, and I know what to expect from the stock car. The new Championship Edition car has better steering response, cleaner straight-line performance and better damping on the suspension than its predecessors. The rear-axle blocks with the extra toe-in added power-on stability and almost eliminated tail sway. Because of longer shocks and longer front A-arms, the damping on the front was better.

The Houge conversion was a mild surprise. The rear end was nailed to the track; in fact, it was unusual to see the rear end break away uncontrollably while under power. The tires were designed for aggressive traction, and they didn't disappoint me. I did, however, experience airborne problems. Although the car held a nose-high attitude in most jumps, many were definitely nose in! When this happened, the chassis' sharp front end dug a hole in the track and buried itself. The solution was to add a rolled-tip front mini bumper.

STEERING COMPARISON

In the steering comparison test, the stock RC10 tires had limited applications. The rib design handles well in sandy or slightly damp track conditions, but, if the track is loose, or muddy, then you have a problem! With loose conditions, the rib tires fade away until you reduce power to walking speed. In the mud, the ribs fill up with ooze so quickly that they become slicks and, once again, you fade away to the retaining walls. Still, these tires will last a long time and provide decent traction most of the time—it's a good place to start.

The TQ-70 front knobbies on the Houge car are good for aggressive traction; they work where the rib tires won't. They won't last as long as the TQ-71s because they have softer treads and peaked knobby tips. When the tips disappear, the traction disappears, too.

Because of the TQ-70 tires, the steering bellcrank unit and the heavier front-end balance, the Houge car had a better overall response. Its balance gives it 5 percent more weight on the front

(Continued on page 142)

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LYNX II SPORT

(Continued from page 78)

some time to master the car, and we slammed into the wall a few times. I thought the stock shock absorber was fine, but Steve said that it wouldn't function as well on a bumpier track.

Hundreds of variables affect a car's handling, and tracks differ, but the Lynx II did remarkably well when set up according to the instructions. It survived crashes, and we didn't even have a bumper! The kit is topnotch, and the car needs no modifications to be successful at your local track. I'm really looking forward to racing my Lynx this winter!

ward to racing my Lynx this winter!

**Here are the addresses of the companies mentioned in this article:*

CompositeCraft/TRC, P.O. Box 1058, 2211 Charter St., Albemarle, NC 28001.

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.

Tekin Electronics, 970 Calle Negocio, San Clemente, CA 92672.

(Continued on page 98)

TRAXXAS HAWK: THE VALUE LEADER IN KITS AND READY-TO-RUNS.

When you're looking to purchase a new truck, you want to get the most for your money. In order to find the best value, there are many different points to consider. Is the transmission strong enough to hold up without the addition of expensive aftermarket components? Do the shocks provide any real dampening power, or are they just for show? Is the suspension designed properly, and does it operate smoothly while resisting breakage? Is it easy to adjust? Are there aftermarket performance accessories available to customize your truck? Obviously, there is much to think about.

As you carefully consider your choices, think about Hawk, TRAXXAS' newest truck. Hawk's planetary gear transmission uses 48-pitch, metal internal gears, which make it the toughest gear differential in the industry. The telescoping U-joint drive shafts are the same ones used on the National Championship-winning Eagle.

Hawk's high-volume, oil-filled shocks are not toys. They are fully rebuildable to maintain peak performance, and they can be finely tuned with different piston head selections

and adjustable spring height.

Hawk's virgin nylon suspension arms simply won't break and are designed to provide a large amount of usable suspension travel and high ground clearance. Turnbuckles are standard for easy adjustment of the caster and camber angles. The tub-style chassis is neat and compact, and the battery mounts longitudinally for superior weight distribution.

It is easy for anyone to make Hawk beautiful with the Lexan body and complete chrome and neon decals. For even more versatility, Hawk can be customized with all the same TRX performance accessories (i.e. ball differential) that propelled the TRX-T Eagle to

TRAXXAS' first National Championship.

When you compare, you'll find that Hawk kit offers many more features and superior durability, for less money than a Blackfoot. For a small amount more, Hawk can be purchased fully-assembled with a high powered pistol radio, something the other trucks don't even offer.

You won't find Hawk in a toy store. It is available only through your local hobby dealer. Call or go by today and see for yourself why Hawk's got the others beat.



OFF-ROAD NATS



KEITH JOHNSON'S
JR-X2

CONCOURS
2ND PLACE

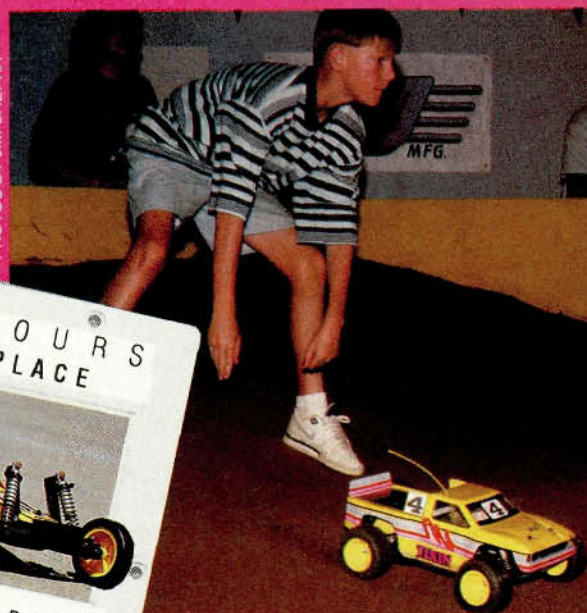


MIKE PURL'S
GHOST RIDER

THE 1990 NORRCA Off-Road Nats was hotter than the record-breaking heat wave that enveloped Dallas in early July! With temperatures soaring to the 100-degree mark and humidity high enough to make it rain indoors, 366 racers converged on Norm's Hobbies and Raceway for NORRCA's biggest event yet.

by JIM SHEPKA

PHOTOS BY JIM SHEPKA



CONCOURS
3RD PLACE



RICK HOBBS'S
PENNZOIL RACER

2 - HIP
DIRT
TRIP

OFF-ROAD NATS

WINNERS

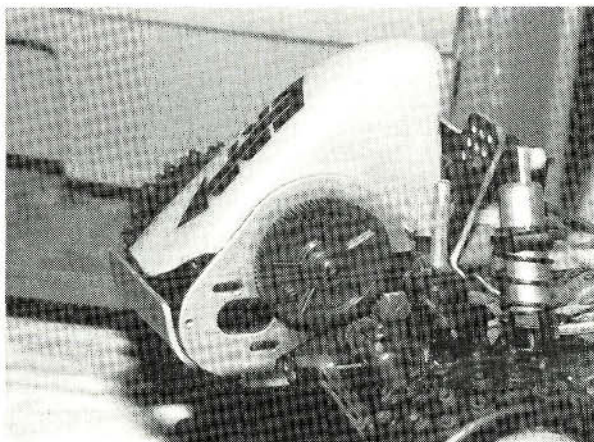
Even nostalgia makes its way into the off-road truck racing scene with this Parma '57 Chevy pickup—adds to the fun.



The tight, twisty, nine-turn track with its 105-foot front straight presented drivers with some tough decisions, i.e., what line to take and which motor/battery combination to use. Although the track's surface held up well (thanks to the efforts of the N.T.O.R. volunteers), it was very easy to overpower. Drivers switched back and forth between six and seven cells and hotter and milder motor combinations. Precious time could be made up if you took the double jumps and the washboard section on the correct line. Throughout the event, these two areas separated the front-runners from the "also rans."

After a controlled practice session on Thursday, the first round of qualifying was scheduled for 8:30 Friday morning. With NORRCA President J.R. Sitman at the controls and the help of

track owners Norm and Karen Mazzola and a host of volunteers, everything went off without a hitch. Thirty-nine qualifying races per round were completed in an average of less than 6 minutes each! After each heat (there's



This scoop keeps air moving over the motor, and this increases run time.

that "H" word again!), a tape-recorded message counted down the time remaining till the next one, and this kept the drivers and the corner marshalls on their toes!

QUALIFYING

In the first round of 2WD Stock qualifying, Scott Roberts and David Hill got the most out of their Trinity stock hand-out motors and completed 11 laps in 4:12.46 and 4:15.22, respectively. There was little change after round 2, but things began to heat up in Saturday's qualifiers. Eight of the 10 A-Mainers turned in their best times—all in the 11-lap range. Chris White took TQ honors with a 4:05.96 effort, followed by Carlos Gonzales (4:07.63) and J.J. Trujillo (4:10.01). Rich Boomsma took the final spot with a 4:16.67.

In 4WD Stock, Carlos Gonzales (in his Endurance Racing Products

ride) was miles ahead of the competition! His 11/4:05.21 TQ run (in the first round) was more than 9 seconds faster than that of the 2nd-place qualifier,



Four-wheel-drive Stock Main.



Super Stock truck Main.



Four-wheel-drive Open Main.



Open Truck Main.

2WD STOCK

Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Chris White	1	RC10	T H	Tekin	ERP	Losi
2	Carlos Gonzales	2	RC10	T H	Tekin	ERP	Losi
3	David Hill	8	JR-X2	R A	Tekin 700	Team Action	Losi
4	J.J. Trujillo	3	JR-X2	I N	Tekin Pro	Peak Perf.	Losi
5	David Joor	4	RC10	N D	Novak	CHU	Losi
6	Tony Fagan	6	RC10	I O	Tekin 600	N/A	Losi
7	Chris Gillihan	7	JR-X2	T U	Tekin 700	CAM	Losi
8	Gene Mason	9	JR-X2	Y T	Novak T-1	ERP	Losi
9	Rich Boomsma	10	RC10		Tekin	N/A	Losi
10	Scott Roberts	5	JR-X2		Novak	Prime Time	Losi

4WD STOCK

Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Carlos Gonzales	1	YZ-10		Tekin	ERP	Losi
2	Chris Allison	2	Pro Cat		Novak	Trinity	Schumacher
3	Brian Stricklin	3	Pro Cat	T H	Futaba 116	Team Action	Schumacher
4	Jeff Holsted	10	Lazer	R A	Novak T-4	Trinity	Hot Lap/Losi
5	Sandy Hunt	5	Lazer	I N	Tekin 700	ESP	Pro-Line
6	Richard Starr	4	YZ-10	N D	Novak	Trinity	Schumacher/Losi
7	Doug Handel	7	YZ-10	I O	Novak	LC Sidewinder	N/A
8	Jimmy Mills	6	YZ-10	T U	Tekin	N/A	Pro-Line
9	Matt Larue	8	YZ-10	Y T	Victor	N/A	Losi
10	Todd Handel	9	YZ-10		Novak	LC Sidewinder	N/A
11	Ray Howard	11	A&L Lazer		Novak	ESR	Pro-Line/Losi

SUPER STOCK TRUCK

Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Scott Brown	4	JR-XT		Tekin 700	Prime Time	Losi
2	David Potter	2	JR-XT	T H	Novak T-1	Prime Time	Losi
3	Bill Ogden	3	JR-XT	R A	Novak	N/A	Losi
4	Mike Dunlap	7	JR-XT	I N	Tekin	Prime Time	Losi
5	Tom Owens	5	Traxxas Eagle	N D	Novak T-1	B&R	JG/Pro-Line
6	Gary Kortz	10	JG SRT-1	I O	Novak	Twister	JG
7	David Hill	6	JR-XT	T U	Tekin 700	Team Action	Losi
8	Todd Handel	8	Traxxas Eagle	Y T	Novak	LC Sidewinder	N/A
9	Jason Branham	9	Traxxas Eagle		Novak T-1	Lightspeed	Pro-Line
10	Cliff Montgomery	1	JR-XT		Titan	Twister	Losi

OPEN TRUCK

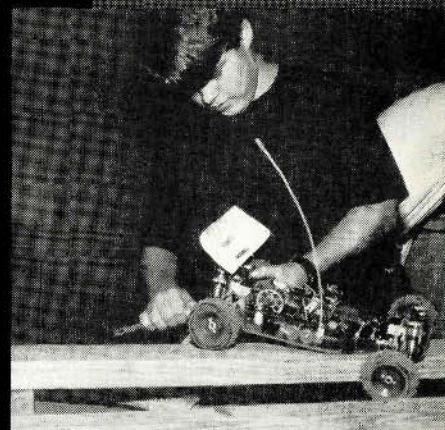
Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Tom Owens	8	Traxxas Eagle	B&R	Novak T-1	B & R	JG/Pro-Line
2	Kyle Reed	2	JR-XT	Revolution	Tekin 610	Prime Time	Losi
3	Scott Montgomery	9	JR-X2/Pro-Line	LC Sidewinder	Novak T-1	LC Sidewinder	Pro-Line
4	Jack Johnson	1	JR-XT	Revolution	T-610	Prime Time	Losi
5	Gary Kyes	5	JR-XT	Revolution	N/A	Prime Time	Losi
6	David Hill	10	JR-XT	Lightspeed	Tekin 700	Team Action	Losi
7	Steve Ozuna	6	JR-XT	Twister	Novak T1-X	Twister	Pro-Line/Losi
8	Mike Dunn	3	JR-XT	Race Prep	Novak M1-c	Race Prep TNT	Losi
9	Wylder Barrows	7	JR-X2/Pro-Line	Quarterflash	Novak T-4	Quarterflash	Pro-Line
10	Steve Dunn	4	JR-XT	Race Prep	Novak M1-c	Race Prep TNT	Losi

4WD OPEN

Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Jack Johnson	1	Lazer	Revolution	Tekin 620	Prime Time	Losi
2	Gil Losi, Jr.	4	Lazer	Revolution	Novak	Prime Time	Losi
3	Mike Dunn	2	Pro Radiant	Race Prep	Novak M1-c	Race Prep TNT	Losi
4	Rick Vehlowl	3	YZ-10	Reedy	Novak M1-c	Reedy	Yokomo/Losi
5	Brian Kinwald	5	RC10	Reedy	Novak	Reedy	Pro-Line/Losi
6	Steve Ozuna	7	Lazer	Twister	Tekin 700	Twister	Losi
7	Dominic Sellers	8	A&L	UNO	Novak T1-X	ESP	Yokomo
8	Chris Allec	10	A&L	Twister	Novak MX-c	Twister	Yokomo
9	J.B. Hunt	6	YZ-10	Peak Perf.	Tekin 700	PT 1	Pro-Line
10	J.D. Beckwith	9	YZ-10	Reedy	Novak MX-c	Reedy	Yokomo

2WD OPEN

Fin.	Name	Qual.	Chassis	Motor	ESC	Batteries	Tires
1	Jack Johnson	1	JR-X2	Revolution	Tekin 610	Prime Time	Losi
2	Gil Losi, Jr.	10	JR-X2	Revolution	Novak	Prime Time	Losi
3	Mike Tuntakit	7	RC10	Twister	Tekin	N/A	Losi
4	Cameron Kellogg	4	Traxxas RTR	Revtech	Tekin 700	Revtech	Losi
5	Kyle Reed	3	JR-X2	Revolution	Tekin 610	Prime Time	Losi
6	Mike Dunn	2	JR-X2	Race Prep	Novak M1-c	Race Prep TNT	Losi
7	Chris Allec	9	A&L	Twister	Novak MX-c	Twister	Losi
8	J.D. Beckwith	8	RC10	Reedy	Novak M1-c	Reedy	Losi/Trinity
9	Steve Dunn	6	JR-X2	Race Prep	Novak M1-c	Race Prep TNT	Losi
10	Rick Vehlowl	5	RC10	Reedy	Novak M1-c	Reedy	Losi/Yokomo



Clean your car and tires between heats.

Chris Allison. Only four other drivers managed to crack the 11-lap barrier, and Brian Stricklin, Richard Starr and Sandy Hunt rounded out the top five. (Cliff Montgomery would have qualified 4th, but he was disqualified for being a pro driver.)

Only 5 seconds separated the top seven drivers in Super Stock Truck. Tom Owens of Team Traxxas set the early pace with a 10/4:05.91 effort that was later eclipsed in round 3 by Cliff Montgomery's TQ run of 10/4:00.79. The most changes on the leader board happened in Saturday's qualifying rounds. Scott Brown made the show on his final (and only!) run, completing 10 laps in 4:02.94. With so many drivers turning in such competitive times, the A-main was shaping up to be great.

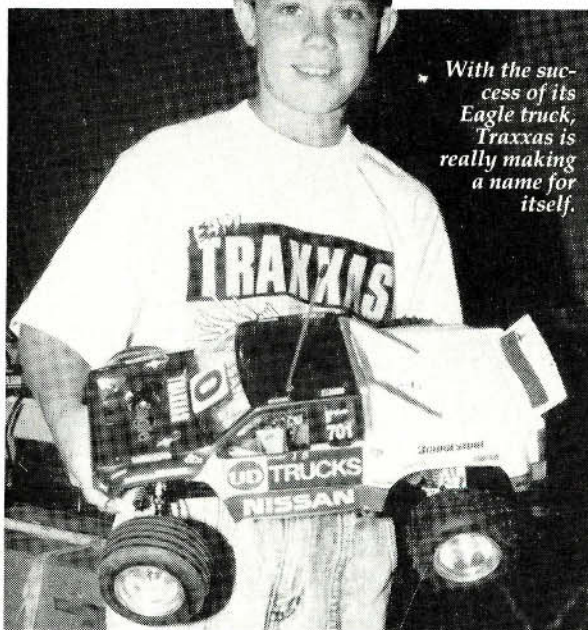
OPEN QUALIFIERS

Because of track conditions and expert maintenance, the Open drivers were treated to an ideal racing surface. With the extra horsepower of their open motors, they went "all out" in the rhythm and jump sec-

OFF-ROAD NATS

tions. Passes were often made in mid-flight (à la Supercross!), and this provided the spectators (and the corner marshalls) with a lot of exciting action. Unfortunately, some drivers hadn't heard of Newton's Law (what goes up must come down), and they slammed into the backs of jumps with frightening regularity!

Team Losi's Kyle Reed set the early pace in round 1 of the 2WD Open with a run of 11/4:02.64. Teammate Gil Losi, Jr. also turned in his best run—11 laps in 4:09.00—to qualify “on the bubble.” There was little improvement in Friday's round 2,



and the drivers went back to the hotel still looking for the elusive winning setup.

Saturday brought out their best efforts,

and qualifying times greatly improved. Team Losi's Jack Johnson and Race Prep's Mike Dunn went head to head in round 3, and both drivers topped the 12-lap mark. Johnson's TQ run of 4:17.87 was a little more than 3 seconds faster than Dunn's, and Reed, Cameron Kellogg (Team Traxxas) and Team Associated's Rich Vehlow rounded out the top five. A scant 4 seconds separated positions 4 and 10!

In the 4WD Open Class, all the top qualifiers broke into the 12-lap range. The A-Mainers must have spent Friday dialing-in, as they set their fastest times on Saturday. Jack Johnson TQ'd in the third qualifier with a 4:10.36, followed closely by Mike Dunn (4:11.72 in round 4) and Rich Vehlow

(4:14.89). Chris Allec (of A&L) squeezed into the final qualifying spot with a 4:21.27.

In the popular Open Truck Class, Tom Owens posted the only 11-lap run in the first qualifier with his Traxxas Eagle. Jack Johnson “turned the trick” in round 2, but he was still 2 seconds shy of the top spot. Many of the top drivers struggled to find the right power combination and did poorly on the first day, but you can't keep guys with this much experience down for long!

If round 3 was any indication, the A-Main was going to be awesome! Jack Johnson completed his TQ weekend with an outstanding 11/4:03.49, beating Kyle Reed to the line by a mere .05

second apart as they crossed the finish line!

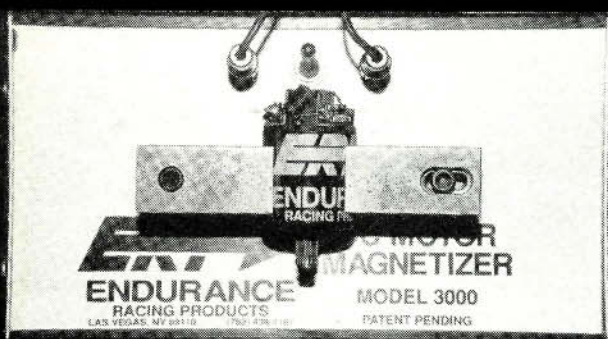
CONCOURS

Concours was held before Saturday's qualifying rounds, and many incredibly detailed machines “made the call.” When the ballots had been tallied, Keith “Yami” Johnson took home the gold with a really sharp paint job on his JR-X2, complete with full interior. Mike Purl was 2nd with his Ghost Rider monster truck (with working lights!), and Rick Hobbs' Pennzoil-sponsored racer won the bronze.

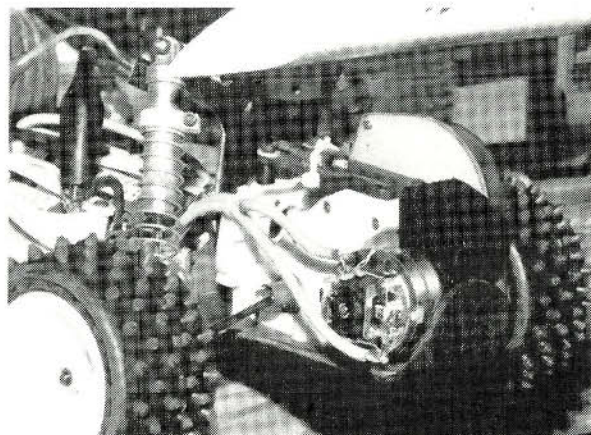
THE MAINS

Anticipation was high for Sunday's Mains, especially in the Monster Truck Classes, as

MOTOR MAGNETISM



I ran across an interesting item at the NORRCA event—a DC-powered motor magnetizer that's built and distributed by Dave Cleveland of Endurance Racing Products. His team members used it to place three cars in the Stock 2WD A-Main and to take the number-one spot in 4WD Stock! Run off a 12V power supply, this device is designed to rejuvenate tired old motors and to give you that “extra edge” with the new stock handouts. Dave claimed there was up to a 4000rpm gain and a reduced amp draw on the motor that won the 4WD Stock A-Main! I'll do a product review in a future issue of *Car Action*, so stay tuned!



A&L's new Lethal Weapon transmission for the RC10 (on Chris Allec's car).

second! The Dunn brothers waged their own battle for 3rd (separated by .69 second), and Owens, Scott Montgomery and Dave Hill were less than a

this was Traxxas' home track. To be fair, the track was redesigned and a new surface laid a few days before the event, so

(Continued on page 162)

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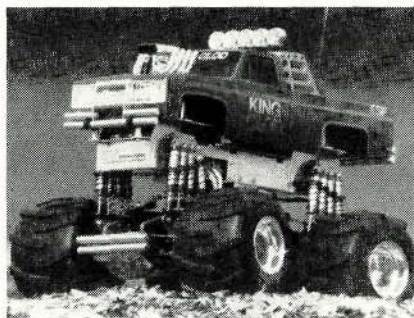
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LYNX II SPORT

(Continued from page 90)

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Andy's R/C Products, 466 W. Arrow Hwy., Unit K, San Dimas, CA 91733.

Pactra/Plasti-Kote Co., 1000 Lake Rd., Medina, OH 44256.

Custom R/C Graphix, 4138 Boston Rd., Bronx, NY 10475.

MADCAP CONVERSION

(Continued from page 83)

upper suspension-rod mounting holes on the front shock tower. Use a hobby knife to widen the holes on the steering bellcrank slightly, and screw in another set of 3mm ball links. Use the 3mm nuts and some thread lock to hold them in place.

Before you try to re-install the

bellcrank cover, trim about 1/4 inch off its sides. Blame it on the ball links and larger rod ends; they need extra clearance, or they'll bind when the truck is moving. To install the Bolink body post in the bellcrank cover, use the screw that comes with the post, and find a washer that's large enough to brace the screw against the large center hole in the cover.

(Continued on page 112)

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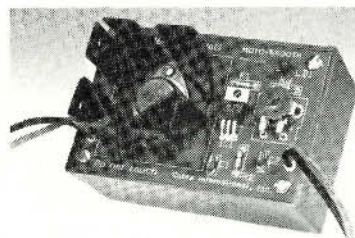
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ROAR

by MIKE LEE

OFF-ROAD NATS



and modified buggies—classes that have always been the mainstay of the off-road race category. The nation's big teams show up for this one!—not for money, but for prestige and bragging rights! For the car manufacturers, a Nats win means increased sales.

In the words of Mike Reedy, the Hobby Haven track is “the most beautiful...ever.” It's pure clay—soft and moist like that at most of the



NO BIG-CITY malls; only one freeway on the edge of town; and probably no more than a dozen police officers for the entire county; but Livermore, CA, was the site of the year's hottest ROAR race—the 1990 Off-Road Nationals

had come to Hobby Haven Raceway! On the north end of town, this is an off-road drivers' paradise!—a beautiful indoor off-road course, with enough pit space and great service.

At stake was the National Championship title for 2WD and 4WD stock

dirt tracks the big guys run on. Traction was outrageous! Need proof? Try these on for size:

- Most drivers preferred to run the Losi X-pattern tire on their rear wheels, but they also found that if they didn't cut their knobbies down by half, their cars simply traction-rolled.
- How about the standard dirt rooster tails thrown by the cars as they slide around corners? Not here; just pure punch and go!
- How about laying down a little rubber at the start of the race?—possible, but unlikely. Most of the time, cars either rocketed off the start, or slipped the diff to oblivion coming out of the hole. As I said, traction was outrageous!

GAME TIME!

DRIVE THE COURSE

The course has its share of jumps and turns, but it also has hills. Let me put you in the driver's seat for just one lap:

Coming down the front straight, you have about 90 feet of open acceleration. You back off the throttle into turn 1—a medium-speed, 90-degree left turn—and a second later, you're into the first jump. The cleanest entry was a swing inward from out wide and square off the jump.

After landing, get on the brakes and the steering to head into turn 2, which is a wide hairpin going downhill to turn 3. This is about 150 degrees, but you've just come downhill, so the turn is a little "slippery." Accelerate hard out of 3 to

head uphill into turn 4. Just as you enter it—a 150-degree sweeping left—you must decelerate over the top of the hill, or you'll lose the rear end. Over the top, you sweep down the hill, out of 4 and into the 90-degree right turn of number 5. You've reached quite a speed as you enter 5, and this sets you up for the small bump between 5 and 6. Too much speed will make you roll, so you're at only half throttle. Enter turn 6—another 90-degree right—but uphill, this time. Straighten the wheel slightly, and then square off the corner entering turn 7.

At 7, you face the doubles; too much power and you'll launch past turn 8; too little hangs you up between the

doubles; and anything other than a head-on jump will cause all kinds of trouble. Once clear of the doubles, hit the hard left of turn 8 for 90 degrees, and then face the awesome triples. Nobody clears the triples! Nobody! Face it; you'll have to get two and then one, and as you do, you land in the middle of the final turn 9—90 degrees onto the main straight where you finally open up for a breather. It isn't a terribly difficult track, but one on which driving skill wins every time.

There were a staggering number of entrants! Modified classes: 284 cars. Stock classes: 193. Nearly 500 cars! Obviously, there was little time for qualifying rounds. For the most part, four qualifiers were run, followed by the Mains.

Left to right:
2nd-place winner Gil Losi Jr., 3rd-place Jack Johnson, winner Cliff Lett and 4th-place Kris Moore.

STOCK-CLASS RACING

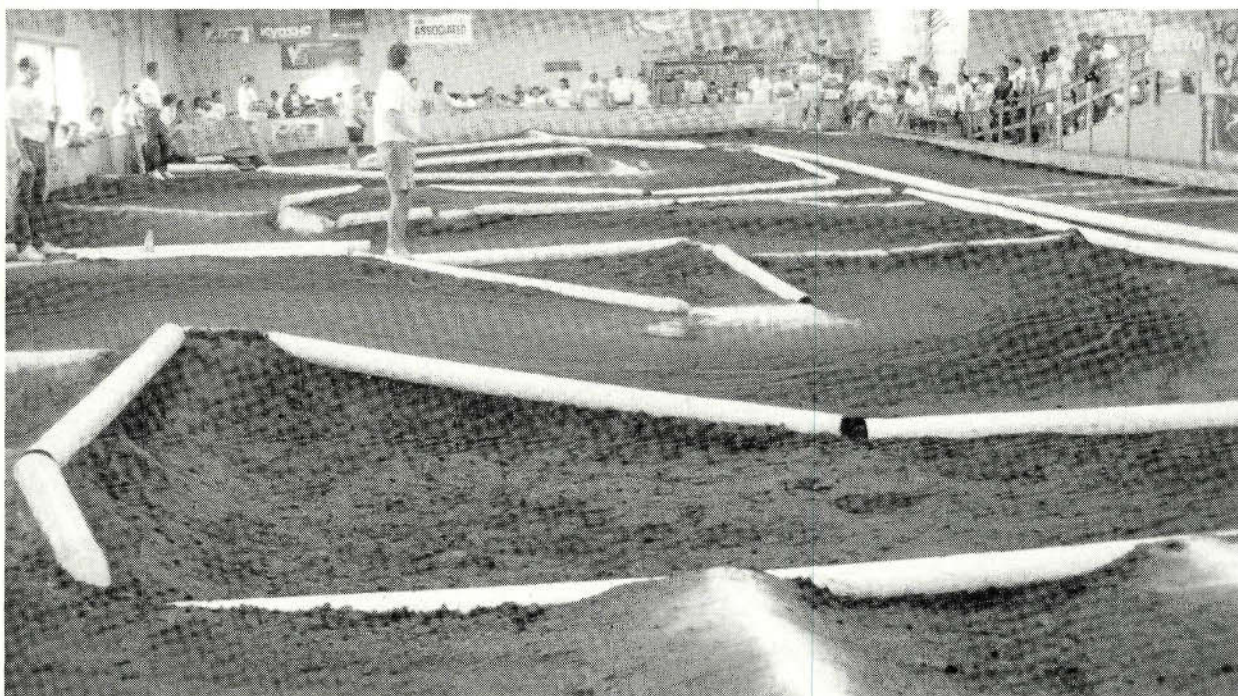
This was run during the second week of the Nationals, so if you planned to race in both Stock and Modified, you had to be in lovely Livermore for two weeks. **The C-Main:** the top six drivers "freight-trained" around the

Championship.

It's interesting that most of the finishing times were close. The handout motors obviously had little to do with the outcome. And they said that Stock Class was dead?!

had the right tires. Only two laps separated the top and middle drivers, and the ability to drive in traffic was every racer's most valuable asset.

After the first two qualifying rounds, Cliff Lett had the TQ position, followed by J.D.



An overall shot of the Hobby Haven indoor dirt track—site of the 1990 ROAR Nationals. Always well-groomed, this track had gobs of traction (almost like running on asphalt with jumps).

track for 4 minutes, each within striking distance of the lead. At the end, Chris Miksovsky was 1st, only 1½ seconds ahead of Gil Losi Sr., and Joe Morettini was 3rd.

The B-Main: the Associated Team brought out its number-one "fun" driver, Curtis Husting, who really enjoys himself, especially when he wins. Not far behind Husting were Scott Roberts and Matt Francis. They were obviously dicing it out big time, as they finished just .22 of a second apart. (At racing speed, that's about 2 feet.)

The A-Main: this was a classic "slug fest" between two drivers, who left the rest of pack behind. Kyle Reed and John Bagakis dueled for most of the race and were the only ones to complete 15 laps—well ahead of any 3rd-place contender. Reed edged out Bagakis by a little over 1 second to capture the Stock Class

2WD MODIFIED

This is the class that makes the headlines! This is where the experimental stuff is put onto the track for the test of competition, and everyone wonders who has what! This time, there were few tricks up the sleeves of the major teams. The most talked-about new item was Associated's so-called "Stealth" tranny. Associated also showed off a set of Teflon shock bodies, and Novak and Tekin brought the latest in speed controllers, including those with torque-limiting circuits. Some drivers were still dialing-in their SCs when the time for glory arrived! And a few tire manufacturers were on hand to help drivers find the right tire to win.

Qualifying began on Friday (just two rounds), as did the Modified 4WD races. Times were all over the board, but conditions favored the drivers who

Beckwith, Steve Dunn, Gil Losi Jr., Brent Wallace and Jack Johnson. Their track times were within fractions of a second, so the AMB electronic scoring sys-



tem was vital. The scoring pick-up line was buried under the track surface, so drivers didn't have to pass under a scoring bridge.

The management of the course

There was no Concours event, but this car would have been an excellent candidate.

ROAR

OFF-ROAD NATS

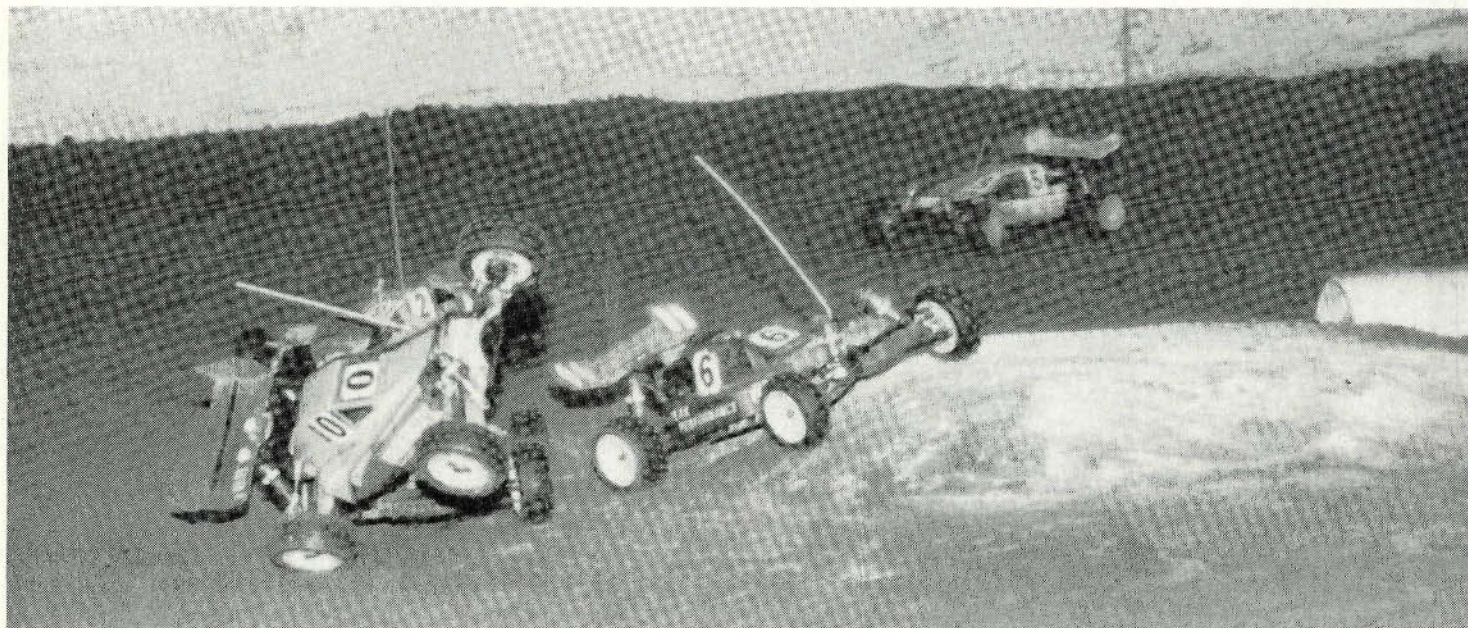
was excellent; thanks to a night crew with a Rototiller, the track was always in perfect condition. Between each heat, a group patched any dents in the soft clay, and each pit area was as clean as the day the track opened. There was even a large table with buckets of water for cleaning mud off your tires. Definitely a class act!

Final qualifying on Saturday

Halsey—led the pack, but he didn't have a good week. Shortly after arriving at the track, he was "jammed" by a virus that prevented him from all but one day of qualifying. Having missed all the practice and the entire first day of qualifying, he was able to TQ only in the C-Main, but he proved he's a force to reckon with. At the start, he led and then easily stretched his lead over the

had a tough time holding off repeated charges from Carlos Gonzales, Chris White, Derek Furutani and Matt Francis. The result was some really close dicing. In the end, Francis had a significant lead over Bagakis, who took 2nd, and Ken Petterson emerged in 3rd.

The A-Main: the top names and equipment took the lead for the big battle. Cliff Lett kept his TQ



Cars take to the high-traction turns. Note the absence of dirt flying off the tires (shows the hard-packed clay gave stupendous traction).

did little to reduce Cliff Lett's strangle hold on the TQ position. A methodical mechanic, Lett inspected every part of his car after each run, so it was always clean and ready to go.

The C-Main: one of our favorite off-road heroes—"Jammin" Jay

4-minute course. Kyle Reed finished 2nd, more than 20 seconds and one lap down, and Randy Locken captured 3rd.

The B-Main: Mark Francis and John Bagakis took off running and had a ball, but while they had fun out front, Ken Petterson

position through four qualifiers. Young J.D. Beckwith captured the outside, first-row position, and in the second row, brothers Steve and Mike Dunn were next to each other. In the third row, Brian Kinwald was to the inside of Gil Losi Jr.; Jack Johnson sat

STOCK CLASS

C-MAIN

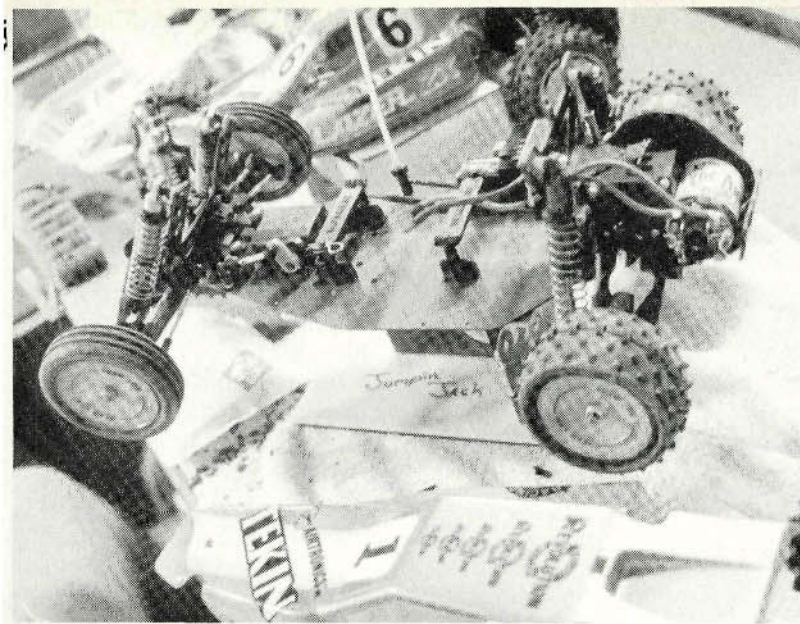
1	Chris Miksovsky	14	4:07.19
2	Gil Losi Sr.	14	4:09.67
3	Joe Morettini	14	4:11.20
4	Dave Krider	14	4:15.00
5	Billy Spence	14	4:16.31
6	Eric Gebhard	14	4:17.16
7	Chris Fedock	13	4:14.67
8	J.J. Trujillo	9	DNF
9	Keith Kenavvyer	6	DNF

B-MAIN

1	Curtis Husting	14	4:05.65
2	Scott Roberts	14	4:07.25
3	Matt Francis	14	4:07.47
4	Jeff Swartz	14	4:09.89
5	John Vigil	14	4:11.86
6	Tim Bump	14	4:15.27
7	Matt Splivalo	14	4:16.92
8	Jesse Watson	13	4:01.31
9	Stephen Miniea	12	4:11.09

A-MAIN

1	Kyle Reed	15	4:10.21
2	John Bagakis	15	4:11.37
3	Ron Williams	14	4:00.10
4	John Walters	14	4:06.48
5	Donnie Hawkins	14	4:13.73
6	Justin Dunbar	14	4:15.87
7	Joel Gallegos	13	4:04.72
8	Tim Hansen	13	4:05.60
9	Mike Meighein	13	4:10.43
10	Curtis Stock	13	4:10.87



Jack Johnson's JR-X2 in the pits. Note the oversize front shocks.

next to Brent Wallace in the fourth row; and Rick Vehlow and Rick Hohwart took up the rear. After the pomp and glory of being introduced to the crowd, the racers were ready to go.

Leading the pack out of the start, Lett had a magnificent holeshoot and hit the first-turn jump in the lead. Brent Wallace somehow found a hole and hit the jump second, followed by Hohwart, Dunn and Beckwith. By lap two, Lett was gone! Beckwith came to 3rd place to challenge Wallace, who was just 2 minutes down. Dunn was in 4th, with Gil Losi Jr. breathing down his tail pipe—not for long, though! Dunn caught a hose barrier, and Losi shot past. Jack Johnson also passed Dunn during that move, but he couldn't challenge Losi. Instead, Hohwart

challenged Johnson, who shut the door on him within a lap. Lett was still way out in front!

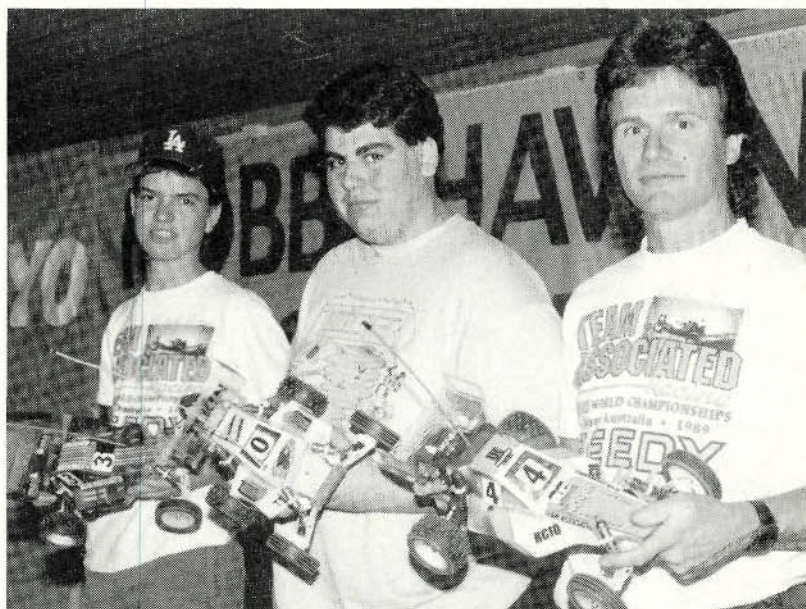
At 2½ minutes, the battle for 2nd heated up, with Beckwith putting the pressure on Wallace. During this cat-and-mouse chase, both Beckwith and Wallace pulled away from the field, but were still behind Lett. By this time, Johnson had made a costly error that dropped him to last. Steve Dunn was in 5th, but his brother fell off the pace. By the end of the race, Lett

was far ahead, but Beckwith and Wallace entertained the crowd with door-to-door racing.

In the last lap, Wallace was leading Beckwith when he "bobbled" a barrier. This allowed Beckwith to pass, but Wallace stayed close behind. As they passed the finish line, they just made the extra lap, and then fought for 2nd. Over the first jump, they tangled. Wallace made the best of it, but Beckwith made one final stab at him with an inside pass at turn 8. Exiting the triples, Wallace had the edge and dropped the hammer on Beckwith to take the win.

Lett's 1-ounce-overweight, almost-stock RC10 had an aluminum chassis, Losi X-pattern rears and ribbed fronts, an Air-

Left to right: J.D. Beckwith (3rd), Brent Wallace (2nd) and Cliff Lett (1st). Brent wasn't sponsored before this race—he is now!



2WD MODIFIED

C-MAIN

1 Jay Halsey	15 ..4:18.95
2 Kyle Reed	14 ..4:01.42
3 Randy Locken	14 ..4:06.42
4 Darrin Stump	14 ..4:10.60
5 John Koonce	14 ..4:11.70
6 Richard Jamieson ..	14 ..4:17.08
7 Bobby Drummond ..	14 ..4:19.23
8 Sean Masterson	14 ..4:20.49
9 Ron Williams	13 ..4:13.07
10 Mike Tuntikit	13 ..4:21.53

B-MAIN

1 Mark Francis	15 ..4:12.21
2 John Bagakis	15 ..4:16.20
3 Ken Petterson	14 ..4:11.97
4 Carlos Gonzales	14 ..4:13.46
5 Chris White	14 ..4:14.45
6 Derek Furutani	14 ..4:15.27
7 Matt Francis	14 ..4:15.87
8 Dennis Taylor	13 ..4:00.16
9 Scott Anfinson	13 ..4:03.79
10 Steve Chamberlin ...	1 ..0:23.90

A-MAIN

1 Cliff Lett	15 ..4:07.63
2 Brent Wallace	15 ..4:14.28
3 J.D. Beckwith	15 ..4:17.91
4 Gil Losi Jr.	14 ..4:02.08
5 Steve Dunn	14 ..4:04.39
6 Rick Vehlow	14 ..4:06.37
7 Mike Dunn	14 ..4:07.30
8 Rick Hohwart	14 ..4:08.46
9 Jack Johnson	14 ..4:09.39
10 Brian Kinwald	13 ..4:00.93

ROAR

OFF-ROAD NATS

tronics radio, a Novak SC and a Reedy Yellow Dot motor. Amazingly, Beckwith and Wallace had very similar, aluminum-chassis RC10s. (Obviously, the "old iron" is still a potent machine.) Gil Losi Jr. drove his JR-X2 to 4th, very close to the leaders.

drivers and great racing action. **The B-Main:** Darrin Stump must have been on afterburners, as he dominated the race. He didn't dust everyone, though, as Curtis Strawn and Scott Anfinson were always within striking distance as they dived it out for 2nd. Meanwhile, Jay Halsey had

started at the rear and was picking his way through the pack. Bobby Drummond put a stop to that effort and held Halsey back in 5th. By the time Halsey had a chance to pass, it was all over. Stump walked away in 1st, followed by Strawn and Anfinson.

The A-Main: Gil Losi Jr. took the TQ position.

He managed to top the times set by Lett in the final qualifier, and that gave him the starting edge. The 3rd spot was held by Rick Vehlow, followed by Steve Dunn, Rick Hohwart, Mike Dunn, Kris Moore, Jack Johnson, Carlos Gonzales and J.D. Beckwith. The cars in the pack included YZ-10s, Kyosho Lasers and AYK Radiants.

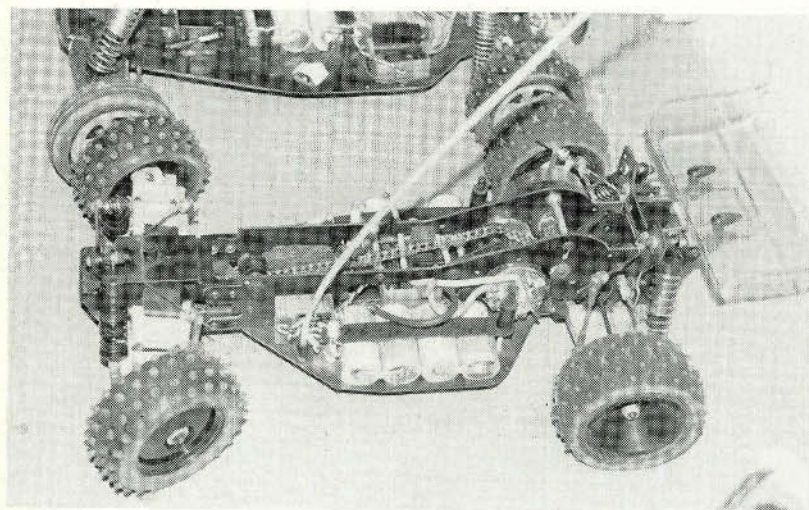
At the start, Gil Losi Jr. did a mad sprint, and Lett was about 20 feet behind with a herd of mad racers close after him. Losi

was smooth and fast, but Lett held on and stayed just within his rear view. This went on for 2 minutes, but Losi hit a barrier, and that put Lett into 1st. Jack Johnson tried to play the same game, as he held 3rd all along. Mike Dunn wasn't having a good time with his Radiant, and was last seen falling from grace. Carlos Gonzales dropped out just short of 3 minutes with a wrecked car, and the rest of the pack was just that—the rest of the pack. Up front, Cliff held a 1-second lead over Losi, who held the same distance over Johnson. The end was anticlimactic when Lett blew across the line at the checkered flag having successfully defended the Nationals title for 1990.

Unlike the RC10 that he drove in 2WD class, Cliff Lett's YZ-10 was anything but stock. He had a Reedy Gold Star motor, the same electronics he used in the RC10 and some handmade tires. He made the chassis (the upper brace is a Jammin' Jay product; the suspension arms and shock towers are experimental units from Yokomo), but the body is stock. Handmade tires?—well, at least, customized. Lett was seen gluing on extra spikes, but kids, don't try this at home. One set of tires will cost you the same as two. (Them spikes have to come from somewhere!)

For his efforts, Lett was awarded the Championship rings

(Continued on page 176)



Mike Dunn's Pro Radiant 4WD car, ready to run. It qualified for the A-Main, but was overrun by the competition.

4WD MODIFIED

It's too bad that 4WD isn't more popular on a local level, but you never would have known it at the Nationals. The 107 entrants made for an outstanding field of

"Jumpin' Jack Johnson is all smiles with his 3rd-place Laser (virtually unchanged since running in the previous 4WD World champs race).



4WD MODIFIED

B-MAIN

1	Darrin Stump	15	4:06.86
2	Curtis Strawn	15	4:11.48
3	Scott Anfinson	15	4:12.19
4	Bobby Drummond	14	4:01.53
5	Jay Halsey	14	4:01.81
6	Derek Furutani	14	4:06.59
7	Bill Jeric	14	4:11.20
8	Brent Wallace	14	4:13.13
9	Mike Burnette	13	4:00.71
10	Brian Kinwald	1	0:17.25

A-MAIN

1	Cliff Lett	16	4:10.93
2	Gil Losi Jr.	16	4:12.52
3	Jack Johnson	16	4:13.13
4	Kris Moore	15	4:05.27
5	Rick Vehlow	15	4:09.39
6	Steve Dunn	15	4:15.65
7	Rick Hohwart	15	4:18.13
8	J.D. Beckwith	14	4:00.27
9	Mike Dunn	14	4:01.92
10	Carlos Gonzales	10	2:57.74

DIRT DIGEST

by BILL O'BRIEN & BOB KANE

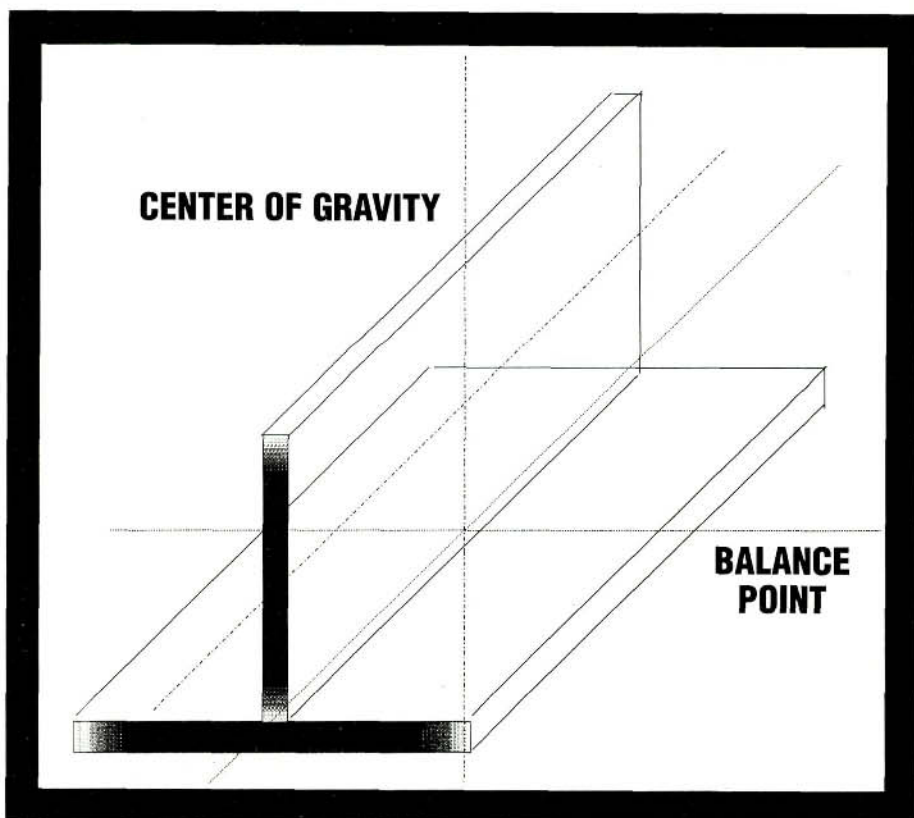
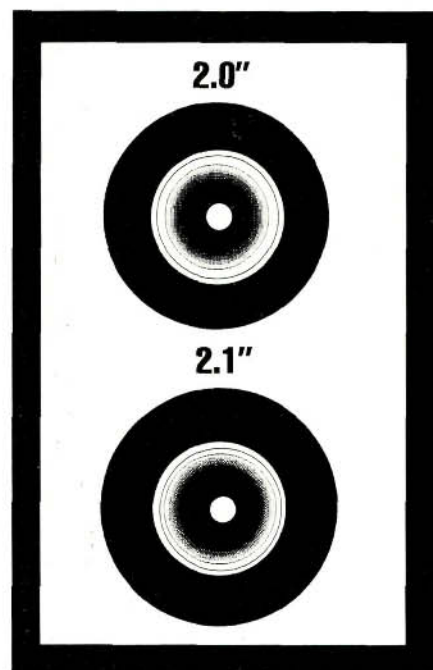
Ground-poundin' geometry

ANYBODY NOTICE that there haven't been any new off-road cars on the market lately? Tamiya* has an Avante 2001 (do we call it "HAL"?), but this year seems to be the year of the truck.

CIRCULAR HAPPINESS?

Being depressed, I started thinking about oval tracks, which are, in themselves, quite depressing. The paved type is particularly so, but even dirt ovals aren't very inspiring. Their continual left turns (interrupted by blistering attempts at short-term high speed) require intense driver concentration and car preparation to keep the wall and wheels from meeting.

What makes driving on an oval track easier and more relaxing?—a well-designed car that's set up correctly for oval running and for the *type* of dirt on a particular oval, too. I bought a



When the inside edge of a car wants to move outward, it rises, crosses over the balance point and then moves the center of gravity past the outside edge—instant flip!

Kyosho* Slingshot because it met these criteria. I haven't assembled it, yet; instead, I'm trying to figure out just what makes an oval car a car that's fit for ovals!

In past columns, I've mentioned most of the components needed to make a good oval car as individual modifications; now let's find a way to put them all together.

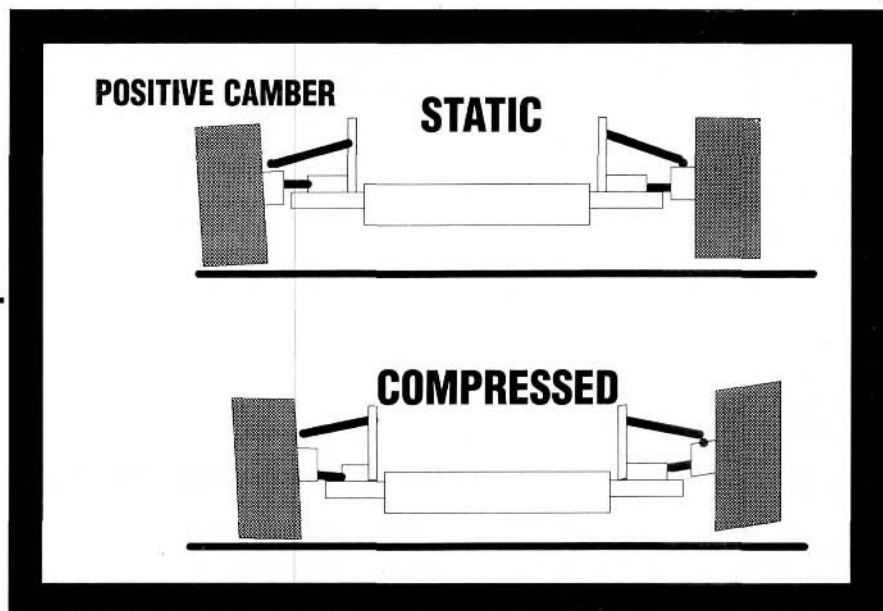
ORBITAL PHYSICS

Several things happen when you drive around an oval. First, centrifugal force tries to flip your car onto its side. At the same time, centripetal force tries to make it oversteer, or understeer, depending on how the suspension is set up. These two forces combined can make a car spin, flip, crash and burn, so I'll examine them one at a time.

BEING FLIPPANT

A car flips when centrifugal force convinces a car that it's unstable by changing its center of gravity (CG). Huh?! Think of your car as two wooden boards of the same length, with one, half the width of the other. The wider board represents the flat horizontal plane created by the tires and suspension; think of it as the car's chassis. Imagine the narrower board glued down along the center of the wider one, so that their lengths match. If you looked at this arrangement head-on, you'd see two, back-to-back, 90-degree angles with equal sides, or an upside-down "T." In an environment where there isn't any motion (called a "static environment"), this is one of the most stable constructions.

To find the CG on our inverted "T," measure from the front to the back to de-



Positive camber might look foolish when your car isn't moving, but when the suspension compresses, it can actually increase tire contact with the track.

termine (and mark) the midpoint. Then measure from side to side (with the ruler's edge on the midpoint mark of the first "longitudinal" line) to determine the latitudinal midpoint. The intersection of the longitudinal midpoint and the latitudinal midpoint is the absolute center of the board—the spot where the bottom board could balance on the head of a pin, so to speak. To calculate the CG, measure straight up from this balance point and, at the halfway mark, you've found the CG. You can calculate your car's CG in the same way.

If you push on your car anywhere below its CG, it might move sideways, but it won't flip—no matter how hard you push. If you push it above its CG, it might flip. In fact, the higher you push above the CG, the less force you'll need to flip the car. You'll also notice that, unless you tip the car so much that its CG moves past its side edge, it will just fall back, but won't tip. If you tip the CG beyond the outside edge of the car, over it will go!

NO TIPPING!

There are two ways to prevent tipping.

- Increase the object's weight so that it's heavier than any force that can act on it. That might work for a couple of wooden boards, but I've never known anyone who competed successfully with a lead chassis!
- Make the object's width greater than its height. There are practical limits to a car's width (as well as ROAR rules), but you can fool centrifugal force into thinking that your car is wider than it really is! Because the forces push on the car from the inside (i.e. the left side on a counterclockwise course) you need only worry about the right side.

That's where wheel offset and tire width come into play. If you use a wheel with more positive offset (one that's been placed further toward the

outside of the axle), you increase the right side's width and make it tougher for centrifugal force to flip the car. If you use a wheel that's slightly wider, too, you increase traction even more. If you use a narrow wheel with more negative offset on the left side (move the wheel further toward the inside of the car), you can maintain the requisite rulebook width. When you move the wheels equal distances, the tire track remains the same, but you shift the CG further toward the left.

STICK TO IT

Once you've solved the flipping problem, you still have to contend with sliding (remember, if you can't tip it, you'll slide it). All the traction in the world won't help if there isn't enough tire surface in contact with the ground, and the tire's width isn't the only factor to consider.

Most "armchair" builders dial-in negative camber (i.e. they tilt the top of the wheel toward the body of the car) on the right side to stop the sliding that always occurs in turns. They think that this braces the car against the pushing force. When your car is always turning, however, its outside suspension never rebounds fully and it runs at a slight (or exaggerated, depending on the stiffness of the suspension) downward tilt to the outside. If you push down on the outside of a car, you induce more negative camber and, in extreme conditions, this leaves you with only the tire's sidewall in contact with the road. That's like rid-

ing on a banana peel!

The rule of thumb is that, at all times, you should have no more than an 88-degree angle, and no less than a 75-degree angle (the angle is formed between the tire and wheel and is measured using the width of the bottom of the chassis as the X-axis, and the height of the wheel and tire as the Y-axis of the angle). That's simple geometry (hence the term "suspension geometry" that's applied to car setups). No, you don't need an education to pull the trigger on your radio, but you do need one to set up a car correctly. Now all that we have to worry about is the steering.

A STAGGERING CONCEPT

To take some of the bite out of continually turning your car to the left, you use tire stagger (the difference in the relative diameters of the tires, after they've been mounted on a wheel).

If two tires have equal circumferences and they rotate at the same speed, they cover the same distance in the same time. When your car turns, the outside tires travel farther (the outside circumference of a turn is longer than the inside circumference because the radius is longer, if you remember your geometry). Your gearbox enables the two wheels to travel at different speeds when necessary.

If you increase the stagger (diameter) on the outside (right) tires and tighten the differential to limit the amount of slipping, the outside wheels will travel

(Continued on page 110)



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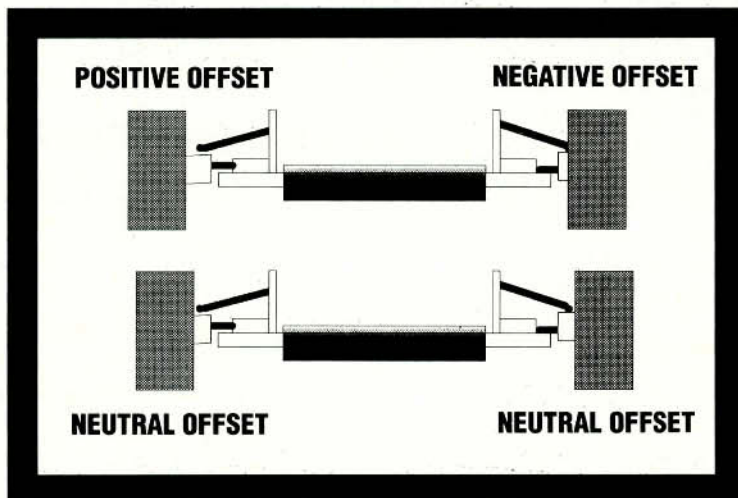
DIRT DIGEST

farther than the inside wheels during the same time. This causes the car to steer to the left, and it lets you worry less about steering it to the left with your transmitter. Here, too, the amount of stagger depends on the radius of the turn, and it can only be determined by driving a track.

If you tighten the differential slightly to limit slipping, you might also think that you should pin the differential to eliminate slipping. You're right; but

or single 180-degree turns. Take a friend with you to the track, and ask him/her to take notes.

When you've finished, you'll have one of the best reference manuals anyone could ever put together! Each time you race on a new track, you can refer to your notes, find the setup you used on similar tracks, and start the day ahead of the pack! Use the practice laps to dial-in the car instead of estimating like everyone else does. (Hey, you



To decrease a car's tendency to flip, extend its track. To keep it within ROAR-legal limits, increase the offset on the outside wheels, and decrease it on the inside wheels.

this would make your car slide. Unless you run a dragster, you need a moderate amount of slipping in the differential at all times. (Now you know why full-size cars come with limited-slip diffs instead of non-slip diffs.)

RACE-LOGY

All of these variables are aspects of the science of racing. They explain why two drivers, with apparently equal skills and seemingly identical cars don't always finish in a dead heat. To increase your ability to win, you need to understand the dynamics of a moving car, and control them so that they always act in your favor. No matter which car you buy, you can't just take it out of the box and expect to win; even if the box says it's RTR (unless it says RTW, for "win").

How can you remember so many variables, especially when each one changes on every track? Well, bunkie, that's why they invented paper and pencils! During your first season, don't worry about winning every race. Instead, learn the tracks on which you run, and the different setups your car needs to handle double 90-degree turns,

could be an entrepreneur—sell copies of your notes to someone who runs with the same setup!) Remember, like Carnegie Hall, the only way to reach the winners' stand is to practice, practice, practice.

NEXT MONTH

Your guess is as good as mine about what will appear next month. There are five or six projects currently under way at the Bad Brain Laboratory of Doom and Pepsi Cola. If I have time, I'd like to assemble (finally!) my YZ-10 and find out about all the extra parts that seem to make it run better. Of course, there's the ever-patient RS-200 that has been officially discontinued. (If they had designed it as a 4x4 Blazer, or a Bronco instead of a hoity-toity rally car, things might have been different!)

It's all possible, and it's all likely. You'll have to be here to find out for sure—see ya then!

**Here are the addresses of the companies mentioned in this article:*

MRC Tamiya, 200 Carter Dr., P.O. Box 267, Edison, NJ 08818.

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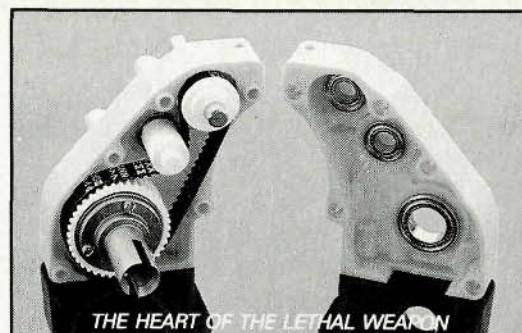
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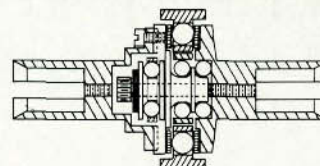
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MADCAP CONVERSION

(Continued from page 98)

To install the extended front axles on the RC10 steering blocks, you'll need 3mm E-clips. The steering blocks are about 1 millimeter too wide to fit into the steering-block bracket (a millimeter is about the width of an "i," but it makes a difference, so don't force them). Mount

them in a vise and sand them down with 80-grit sandpaper or a motor tool. (Be careful with round sanding drums—you want the surface to be flat, not concave.) When that's done, mount the steering blocks into the carriers with the original kingpins.

The rear body mount is a direct bolt-on part, but if you need to modify the back,

you can swap the stock rear axle carriers, axles and dogbones for the beefier King Cab versions. If there's money burning a hole in your pocket, another option is to buy a bearing kit. The low friction provided by bearings is the most affordable way to improve performance by 10 to 15 percent.

(Continued on page 123)

REEDY

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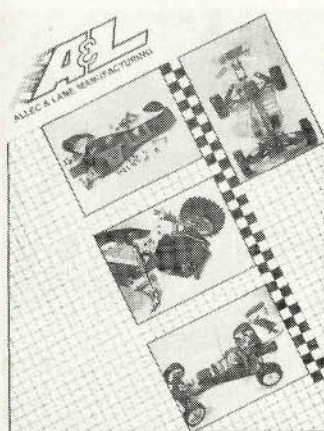
(Graph shown represents actual readout of Reedy Modifieds motor)



Christmas Catalogue Collection

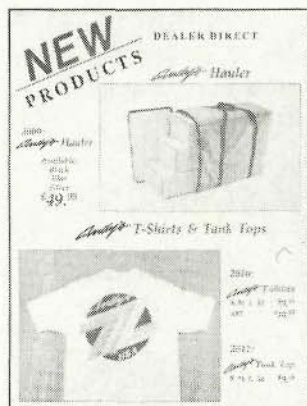
IMPORTANT DECISIONS

Aren't catalogues great? No matter what the time is—bed-time or bath time—you need never be without your most-loved hobby. Catalogues help you to make purchasing decisions while unfettered by the distractions of life. You can disappear, unnoticed, into your favorite nook or cranny to ponder your options and make a sound decision in solitude. Of course, if someone disturbs you, many of these catalogues will fit nicely into a textbook, so no one need know you aren't studying! It's a risk worth taking!



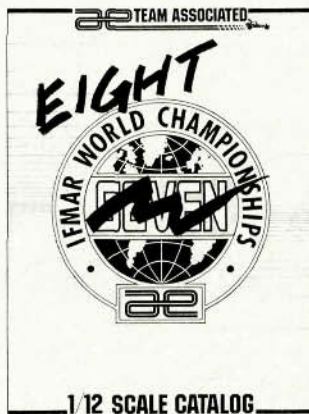
A&L

Allec & Lane manufactures a complete line of products for its conversion kits. Graphite chassis, trailing arms, steering systems and body mounts are just a few of the products available. Send \$2 to Allec & Lane, P.O. Box 2115, Corona, CA 91718; (714) 735-5249.



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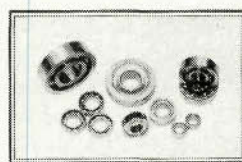
Associated

Associated has five catalogues—for the RC10L, the YZ-10, 1/8 scale and 1/12 scale—and they're available at no charge. Write to Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626, or call (714) 850-9342.

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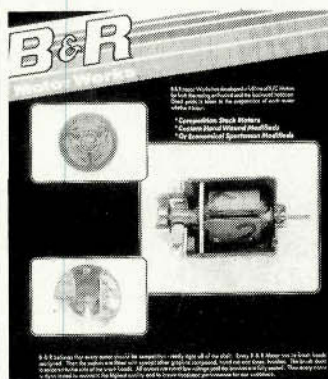
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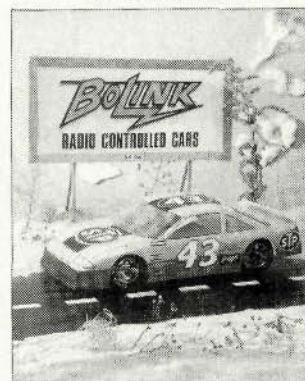


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1305 ABBEY RD.
ROUND ROCK, TX. 78681
1-800-628-8863

Bold Creations

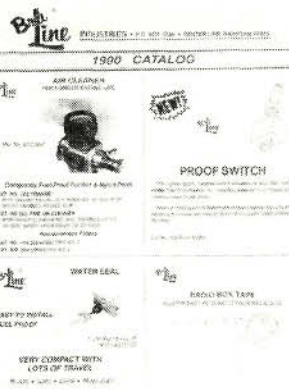
Bold Creations has a unique line of hobby products, including capacitor kits, dischargers, antennas, heat sinks and tires. Send \$1 to Bold Creations, 1305 Abbey Rd., Round Rock, TX 78681; 1-800-628-8863.

1990 CATALOG



Bolink

Bolink's 1990 catalogue includes bodies, motors, car kits and accessories that every racer can use. For a full-color catalogue, send \$3 to Bolink R/C Cars, 420 Hosea Rd., Lawrenceville, GA 30245; (404) 963-0252.



Bru-Line Industries

There's a great collection of parts in Bru-Line's 1990 catalogue, including switches, resistors, motor filters, tools and a complete line of wheels to fit any car. Send \$2 to Bru-Line Industries, P.O. Box 3786, Center Line, MI 48015; (313) 754-4060.

Bud's

RACING PRODUCTS

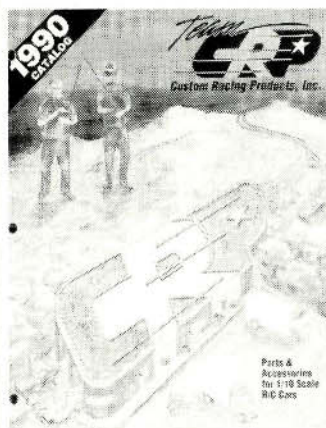
Bud's Racing Products

Bud's offers a line of performance add-ons for R/C cars, and now the company makes motors, lubricants, wings, hardware and more! For a 1990 catalogue, send \$1 to Bud's Racing Products, P.O. Box 610, Amherst, OH 44001; (216) 965-5247.



C&M Cobra

Cobra sells 1/10-scale cars and accessories, including differentials, body mounts and tires. Send \$2 to C&M Cobra, P.O. Box 701353, West Valley City, UT 84170; (801) 967-1914.



CRP

CRP carries hop-up parts for many of today's cars, including a great line of tires, lubes and linkages. For the latest catalogue, send \$3 to Custom Racing Products, 8784 Plata Ln., Atascadero, CA 93422; (805) 466-6945.

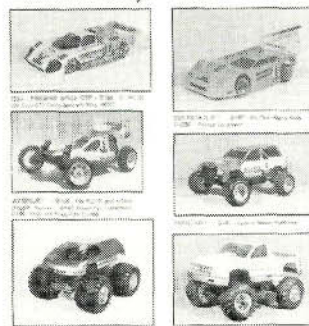


Custom R/C Graphix

With more than 75 colors and endless design capabilities, Custom R/C Graphix can make your next car your best! For a complete catalogue, send \$2.50 to Custom R/C Graphix, 4138 Boston Rd., Bronx, NY 10475; (212) 324-7858.

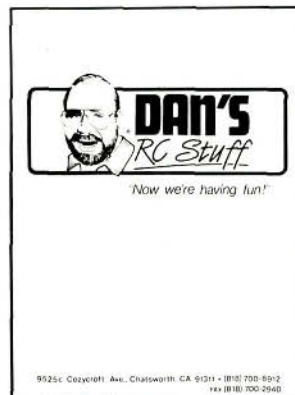
DAHM'S

Racing Bodies



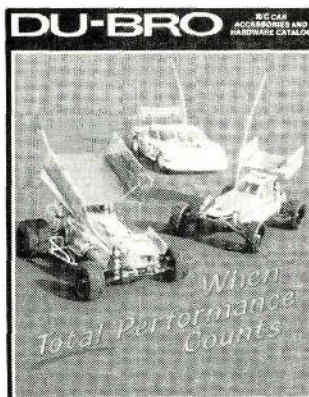
Dahm's

Dahm's has always been known for its great bodies and accessories. To check out the many new items in this year's catalogue, send \$2 to Dahm's Racing Bodies, P.O. Box 360, Cotati, CA 94931; (707) 792-1316.



Dan's RC Stuff

Dan's RC Stuff has many new items for 1990—Grip Strips, an F-1 motor pod and Pro-Cut shrinkwraps, to name just a few. The catalogue costs \$2, and decals are included. Write to Dan's RC Stuff, 9525C Cozycroft Ave., Chatsworth, CA 91331, or call (818) 700-6912.



Du-Bro

Du-Bro hardware is useful for

anyone who owns an R/C car. The new catalogue includes a full line of ball links, turnbuckles, setscrews, nuts and hex screws in both metric and standard threads. Why not order one?—it's free! Write to Du-Bro, 480 Bonner Rd., Wauconda, IL 60084, or call (708) 526-2136.

EDGE

PRODUCTS

(805) 324-1090
2520 H Street, Suite D • Bakersfield, CA 93301

Edge

Edge Products is known for its motor-cleaning sticks, but it has other items that are also worth a look. For a free catalogue, write to Edge Products, 2520 H St., Suite D, Bakersfield, CA 93301; (805) 324-1090.

Futaba



Futaba

Futaba has long been known for its excellent radio-control equipment. Futaba's free 1990 catalogue shows the complete line of radios, servos, speed controllers and receivers with detailed technical information. Write to Futaba, 4 Studebaker, Irvine, CA 92718, or call (714) 455-9888.



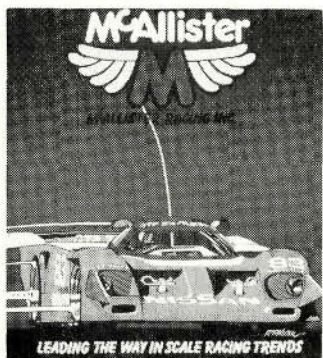
HPI

HPI carries a complete line of wheels, tires, motors and other hobby accessories, and its rims are very stiff and light. For a copy of the latest catalogue, send \$2 to HPI, 22600-C Lambert, Suite 904, El Toro, CA 92630; (714) 837-3250.



JG Mfg.

JG's full-color catalogue includes all its conversion kits and accessories for 1990. For the latest copy, send \$3 to JG Mfg., P.O. Box 6014, Whittier, CA 90609; (213) 947-1206.



McAllister

McAllister Racing has a full line of products to meet all your racing needs. From a complete chassis kit to a body or decals—

McAllister has you covered! For a catalogue, send \$3 to McAllister Racing, 2245 First St., #105, Simi Valley, CA 93065; (805) 583-4473.



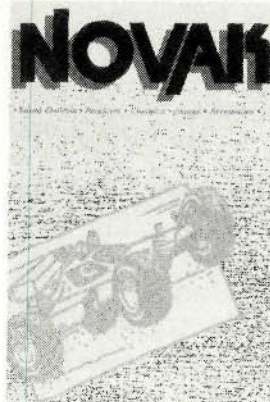
Magic Motorsports

Discover the hot hop-up parts Joel "Magic" Johnson uses, and find out which products he recommends, e.g., pre-assembled saddle packs and purple anodized Yokomo front hub carriers and ball-bearing steering arms. This catalogue (no. 21990) includes product photos and list prices, and it's free with the Trinity catalogue. Magic Motorsports, 1901 E. Linden Ave. #8, Linden, NJ 07036; (201) 862-1705.



MRC

For years, Model Rectifier Corporation has been a giant in radio control. The 1990 catalogue includes cars, boats, planes, radios and engines, and it's available for \$1 from MRC, 200 Carter Dr., Edison, NJ 08817; (201) 985-7800.



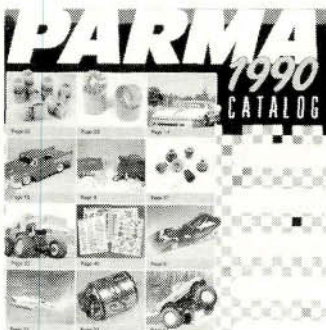
Novak

Novak has a reputation for making great R/C car electronics. The 1990 catalogue contains speed controllers, receivers, servos and chargers, and it's available on request from Novak Electronics, 128-C East Dyer Rd., Santa Ana, CA 92707; (714) 549-3741.



Paragon

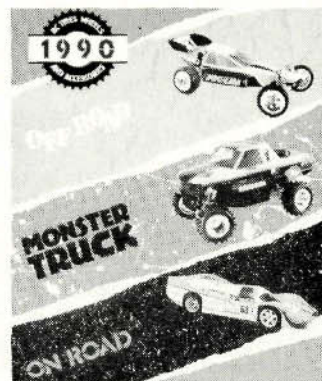
Paragon's product line includes a wide variety of racing products—from motor spray, lubes and traction compound to motors and decals. For a catalogue, send \$2 to Paragon Racing Products, 690 Industrial Circle S., Shakopee, MN 55379; (612) 496-0091.



Parma

Parma offers a truly complete catalogue for 1990 that covers everything from slot cars to 1/8

scale with sections on motors, batteries, bodies and decals. Send \$2 to Parma International, 13927 Progress Pkwy., North Royalton, OH 44133; (216) 237-8650.



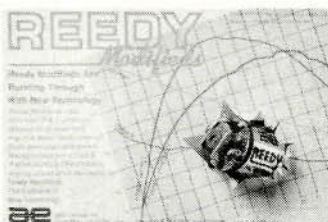
Pro-Line

Pro-Line's 1990 catalogue contains all the info you need on everything from truck conversions and bodies to rims and tires. Send \$2 to Pro-Line, P.O. Box 456, Beaumont, CA 92223; (714) 849-9781.



Royal

Royal's full-color, high-quality, 51-page catalogue contains items like the Royal Crusher and the 4WD Ford F150 pickup. Also available are accessories, ARF planes and beautiful scale kits, including many WW II warbirds like the P-51 Mustang. Send \$5 to Royal Products Corp., 790 Tennessee Ave., Denver, CO 80223; (303) 778-7711.



Reedy

Check out the full line of Reedy Modified, Ultra and Esprit Series motors and accessories!

For a free four-page catalogue (that includes intended uses), write to Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626; (714) 850-9342.



Sanyo

This 11-page color brochure shows the full line of Sanyo cells along with their intended uses. Included are twelve graphs about cycle, charge, discharge and temperature characteristics. For a free catalogue, write to Sanyo Energy Corp., 200 Riser Rd., Little Ferry, NJ 07643; (201) 641-2333.



TMS Products

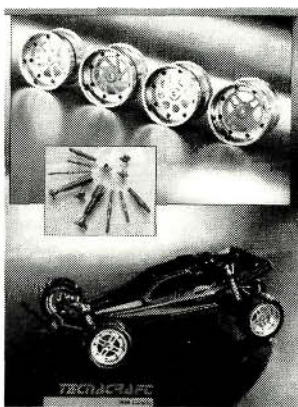
This black-and-white, 7-page brochure includes graphite chassis and shock towers, on-road tires and rims and an extensive line of off-road tires and aluminum wheels. Send \$1 to TMS Products, 1948 Del Amo Blvd., Unit A, Torrance, CA 90501; (213) 320-1946.



TOTAL RACING CONNECTION INC.

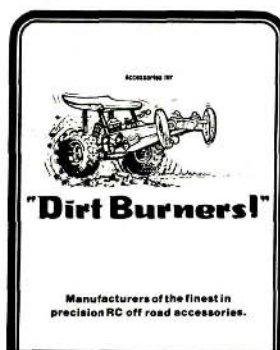
Team TRC

The 20-page, four-color TRC/CompositeCraft catalogue is a comprehensive list of TRC accessories. It's complemented by color booklets on the Lynx II racing series, which features on-road winners like the Lynx II Elite, the Elite Pro 10, the Pro 10X and the Pro 10 Sport. Send \$3 to Total Racing Connection Inc., 221 Charter St., Albemarle, NC 28001; (704) 982-0507.



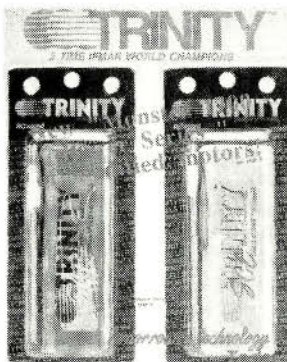
Tecnacraft

For all the info on Tecnacraft's line of aluminum wheels, knock-offs, turnbuckles, output shafts, etc., get the 1990 catalogue. All specifications and prices are included. Send \$2 to Tecnacraft R/C Models & Components, 1335B Dayton St., Salinas, CA 93901; (408) 422-7466.



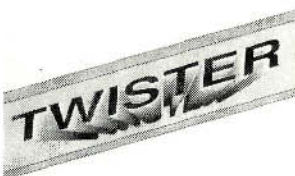
Thorp Mfg.

The "Dirt Burners" black-and-white catalogue includes line drawings of the entire Thorp line of accessories, with ten exploded views of its ball differentials. Descriptions, part numbers and prices for all parts and assemblies are included. Send \$2 to Thorp Mfg. Inc., 4054 East Mission Blvd., Pomona, CA 91766; (714) 622-6518.



Trinity

Trinity's 15-page catalogue includes an extensive line of motors, brushes, batteries, pinions, wheels, tires, shocks, springs and wings! Also included are the Speedworks and Magic Motorsports brochures. Send \$5 to Trinity Products Inc., 1901 East Linden Ave. #8, Linden, NJ 07036; (201) 862-1705.



Twister

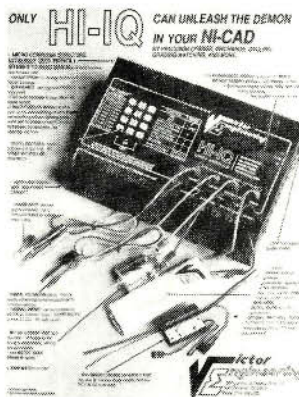
This black-and-white catalogue not only lists all the Twister

motors and accessories, but it also includes a motor tuning guide that covers break-in, cleaning, capacitor and lead wires, brushes and springs. Also included is the line of Premier Design bodies available through Twister. The catalogue is free. Write to Twister Motors, 657 E. Arrow Hwy., Glendora, CA 91740, or call (818) 914-6177.



Twinn-K

This 23-page color catalogue is full of all types of on- and off-road tires, wheels and related hardware. This catalogue will help you to decide what you need, and prices are included. Send \$2 to Twinn-K, Inc., P.O. Box 31228, Indianapolis, IN 46231; (317) 839-6579.



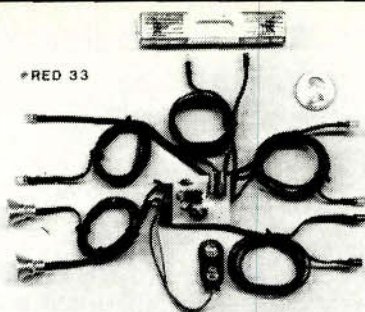
Victor Engineering

Victor Engineering's 1990 catalogue contains complete information on the company's latest products, which include a new computerized speed controller and the HI-IQ charger/cycler—with detailed reviews from major magazines. It's free, so write to Victor Engineering, 380 Camino de Estrella, Suite 170, San Clemente, CA 92672, or call (714) 496-9701.

NEW PACE CAR 10 LIGHT SET

Add the excitement of a Pace Car to your collection of car bodies. This set includes 2 #RED 19 Headlights with aluminum reflectors, 2 tail lights with red lenses, 4 flashing hazard lights with amber lenses and a #RED 07 Light Bar with 2 flashing bulbs and an adjustable rate flasher all wired into one system. You can use a 9 volt alkaline battery or a 6 or 7 cell car nicad pack for power.

#RED 33 \$49.95



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RAM wants to encourage all races and events to begin with pace laps to set an air of excitement! Club presidents and track operators are invited to order ONE Pace Car Set directly from RAM at 1/2 price, \$25.00, plus \$3.00 U.P.S. Use club or business stationary for all orders.

MADCAP CONVERSION

(Continued from page 112)

ON THE ROAD AGAIN

The Magnificent Pond ordered me to make an accurate, precise report of how the MadCab works under pressure. To be accurate, there is no pressure—and, to be precise, it's fun!

I was worried about jumps, but the suspension had just enough travel to work well. (I used 140WT oil in the front shocks, but don't tell anyone!) The MadCab is 1/2 inch lower than the King Cab,

and, because it has less chassis mass and smaller tires, it's a few ounces lighter. This makes it quicker and more aerodynamic. (To be certain that the performance difference wasn't caused by the motors, I tried the same motor in each truck.)

With the stock gearing, the MadCab doesn't accelerate with the gusto of the King Cab, but it has the same top speed. To improve acceleration, change the gearing. I recommend the Robinson* replacement pinion and spur gears. (They're true 48 pitch.)

The stiffer Platinum rear shocks almost

eliminate the original Madcap's tendency to understeer, but, with the extra load of larger wheels and tires, the truck needs a better bellcrank. I think that an Optima Mid setup would work, but I haven't tried it yet. Give me a yell if you do. (Well, you don't expect me to do *all* the work for you, do you?)

The stock mechanical speed controller is holding up like a dream, but if you're worried about smoking yours, just use a King Cab replacement resistor, and you'll run forever.

(Continued on page 142)

CAR ACTION QUARTZ WATCHES FOR R/C SPORTS

from Robic

You won't want to be without one of these handsome R/C sports quartz watches. These beauties look great, and they offer many advanced features:

- Precise quartz analog movement
- Uni-directional, 60-minute elapsed-time ring
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Choose from these dynamite colors: signal yellow, anthracite gray or jet black. Available for only \$29.95 each.

Order yours today!

Credit-card orders only,
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Postage and handling: U.S.: \$2.95 for first item; \$1 for each additional item. Foreign, Air Mail (including Canada and Mexico): \$5.50 for first item; \$2.50 for each additional item. Foreign payment must be made in U.S. funds drawn on a U.S. bank, or by international money order. Foreign, Surface Mail (including Canada and Mexico): \$3 for first item; \$1.50 for each additional item. Connecticut residents add 8% sales tax.

Air Age Mail-Order Services, 251 Danbury Rd., Wilton, CT 06897

BUILD A

T-Bucket

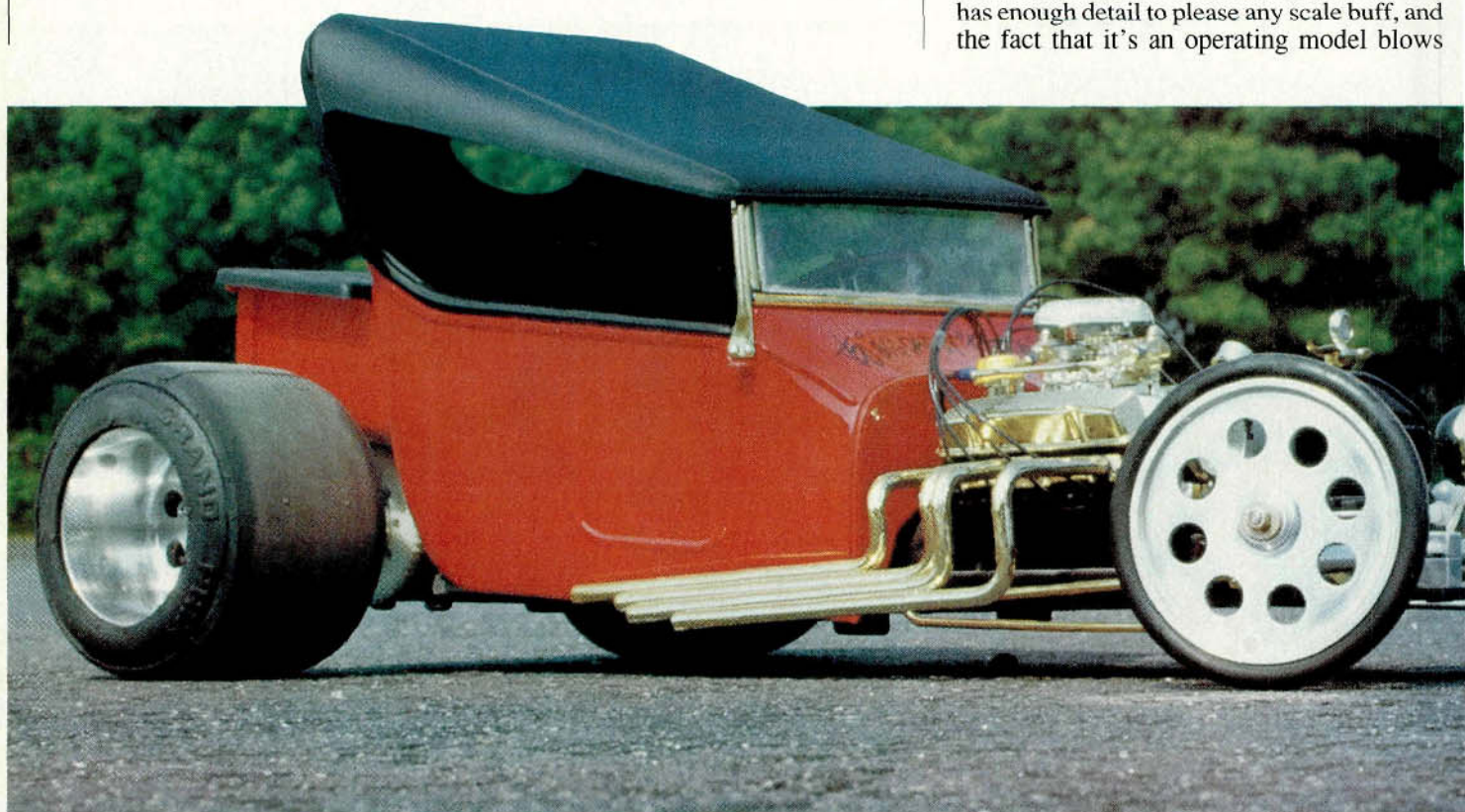
THE EARLY FORD T-Bucket is one of the best-known hot rods, and its origins date back to the most primitive racing cars. These were basically standard cars with the non-essential parts removed to reduce weight. The frame rails, suspension and engine remained, and what was left of the bodywork resembled a bucket (hence, the moniker). With their modified engines, these cars were the racetrack terrors of the Roaring Twenties!

After WW II, hot rods became very popular, and they were modified to make them more comfortable and legal on the highway. The old-style flat-head engines were often replaced with overhead-valve V-8s, usually with multiple carburetion or superchargers. The introduction of the Detroit muscle cars in the late '60s contributed to the demise of the hot rod. Recently, however, T-buckets have made a comeback, and whether they're at shows or on the street, they always draw a crowd!

The model used in this article is based on a real, hot-rod T-bucket, with the technology of the '80s and the classic "look" of the '60s. It should be an easy project for the average R/C modeler. This 1/8-scale rod has enough detail to please any scale buff, and the fact that it's an operating model blows

LOCO FOMOCO

by ERIC GOLDSCHRAFE



PHOTOS BY ERIC GOLDSCHRAFE

everyone's mind! The first one that I built created so much interest that when a hot-roddin' pal asked me to make one for him, I decided to smooth out the problems and create a step-by-step process that anyone could follow.

HEART & SOUL

At the heart of this project is Advance's* Custom Street Machine chassis and a plethora of parts from Monogram's* 1/8-scale Golden T kit. The Custom Street Machine chassis is a special-order item (kit no. M001), and the following items replace the regular kit parts:

- 1/8-scale dragster front wheels and tires
- 6-inch-wide front axle kit
- 14-inch funny-car chassis
- 1/8-scale rear wheels and tires.

First, cut the rear tips off the frame rails. The stock Advance motor mount/axle blocks work perfectly, and you only have to notch the frame rails so that they fit up against the Advance chassis. After you've cut the appropriate reliefs into the plastic frame rails, the inside lower edges should rest against the edge of the fiberglass piece. The rear section angles outward, under the body, so that you only modify the front part as necessary. Scuff the bottom edge of the fiberglass chassis where the plastic frame rails will overlap, and attach the rails to the chassis with a 5-minute epoxy. Make sure that the frame rails are positioned properly on the chassis (see photos). To make the car look realistic, paint the fiberglass and the rear axle blocks flat black so that they won't stand out later.

To position the body over the frame properly, you'll have to trim the lower edge of the firewall. Use the instruction manual to determine the correct location, and remember that the less plastic you cut, the more realistic the model will be. Cement the firewall to the front of the body and allow it to dry.

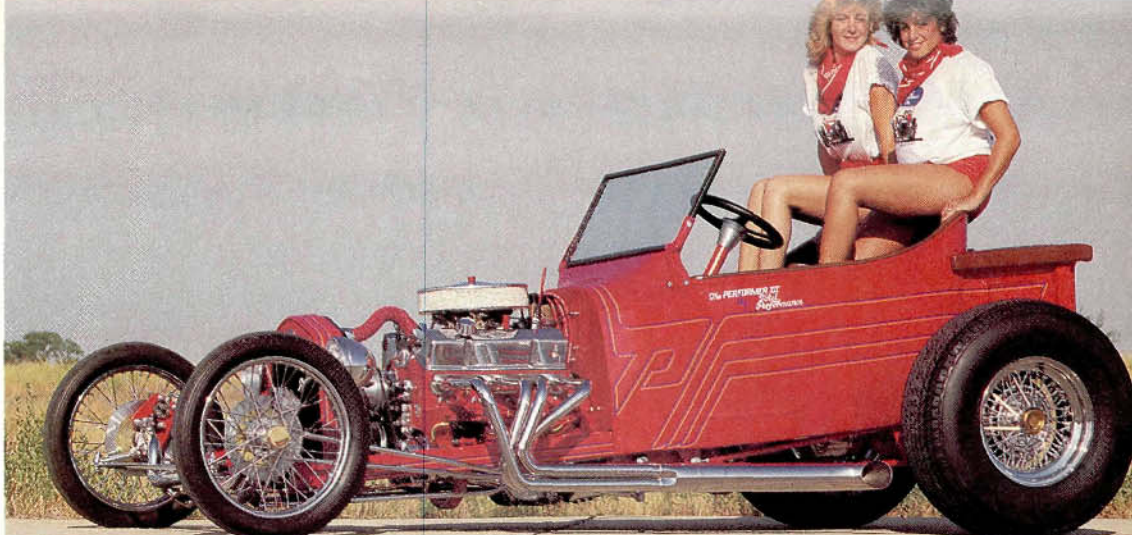


Photo courtesy of Hot Rod Magazine.

by CHRIS CHIANELLI

If you've successfully built a 1/10-, 1/8-, 1/6-, or 1/4-scale kit, you're qualified to build this full-scale T-Bucket and others like it! All you need are larger tools and a bigger budget.

FULL-SCALE BUCKET BUILDING

Gina (left) and Lisa Lauria built their T-Bucket in three days! Ever since their father, Mickey Lauria, founded Total Performance* in 1971, he's had to deal with skeptics who say things like, "I can't weld," or "I'm not very mechanically inclined." Kit cars have also been given a bad name by fly-by-night kit manufacturers out to make a fast buck, but in 1989, Total Performance received the 1989 Best Street Rod Kit award from Petersen's *Kit Car Magazine*.

In 1986, Mickey decided to do something to alleviate people's doubts about building full-scale cars. He sent his daughters, then aged 17 and 19, to the Street Rod Nationals in Oklahoma City, OK, to assemble a pre-painted T-Bucket kit in front of an audience. The girls bolted the car together and, after three days, they started it and drove it away! In those three days, full-scale kit car companies gained much credibility!

Terms like pre-drilled, pre-fitted and pre-welded are nothing new to modelers, so building a full-scale car shouldn't be intimidating, and the great thing about any kit is that you can detail and personalize it from the ground up. The molded fiberglass body is ready for whichever color you choose, and you can fit your favorite powerplant into the light tube frame. Instead of Reedy or Trinity supplying the horsepower, in a full-scale kit it's from a company like Ford or, as in this case, it's a small-block Chevy.

Because the easy-money wolves are always around, you still have to investigate the companies before you buy a car kit, but there are already a lot of ratchet-wielding father/son and husband/wife teams riding in their high-powered T-Buckets. They may cost more (about \$3,000 for a basic kit), and the parts are heavier, but they're still just kits!

(For Total Performance, Inc.'s address and telephone number, see the end of this article.)

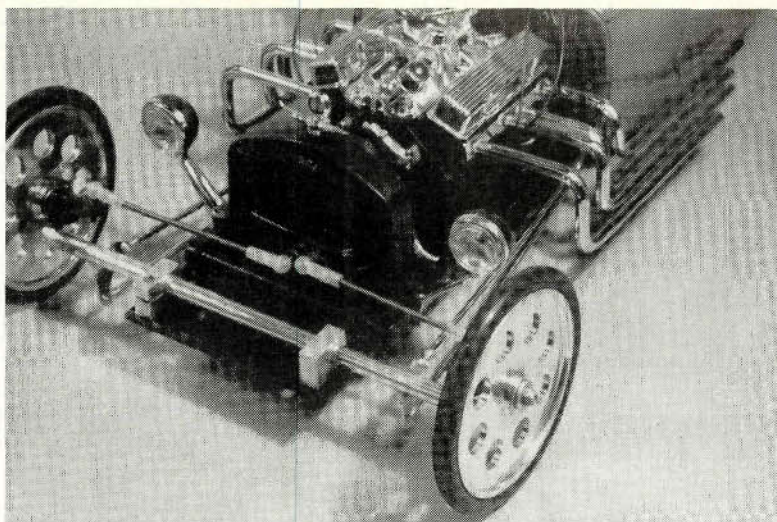


BUILD A T-Bucket

POWER & GLORY

The detail in the plastic kit engine is exceptional. With some crafty alterations, you can use the Holley-carbureted "Mouse" motor intact. Assemble the two halves of the block, the timing cover and the water pump. When the glue is dry, cut off the oil pan at the bottom of the block, all the way to the end of the transmission tail shaft. If you do this carefully, you might be able to save the oil pan and glue it to the bottom of the chassis for more realism. Cut the transmission off the bell housing and discard it, and smooth the lower edge of the block with a file or sandpaper. Position the body; then place the plastic V-8 engine so that the bell housing protrudes into the opening of the firewall. (Follow the instructions for positioning.) Don't mount the engine to the chassis yet—you still need to add detailing, i.e., the electrical and fuel systems, the cooling hoses and lots of plated "dress-up" items, and it's easier to add these with the engine out of the car.

When the glue on the firewall is dry, fit the bucket body onto the frame, using the notches in the firewall as guides to help you position it. You'll see where you'll have to notch the rear of the body so that it clears the right side of the motor mount. Trim the lower portion of the back of the bucket between the frame



The completed front-end details include lights and radius rods.

rails to provide clearance for the wiring that goes into the pickup box. When you're satisfied that the body fits properly, cement the pickup box to the bucket, and set it aside to dry. Don't glue the bed cover into place—this part should be removable.

SHINY DETAILS

Since this project uses wheel rims and a completely exposed front-axle assembly that are made of aluminum, it would be a shame not to polish them. To give these parts a chrome-like luster, use a polishing kit, and mount the buffing wheels in a motor tool like a Dremel. For a smooth, shiny finish, use the tool's highest speed and a high-grade polish.

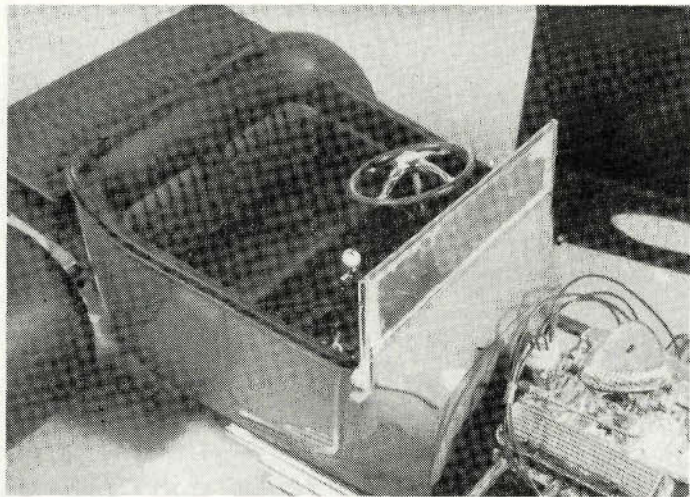
Next, mount the body. To position it at the correct height, mount a small block of balsa wood on the left axle mount and a brass strip bracket on the right mount. You'll need to mount two

smaller L-brackets on the inside of the firewall, above the frame rail notches, to hold the front of the body. Use small pieces of servo-mounting tape to secure the brackets and to attach the body to the frame. Since the bucket isn't usually removed, this mounting method shouldn't cause a problem.

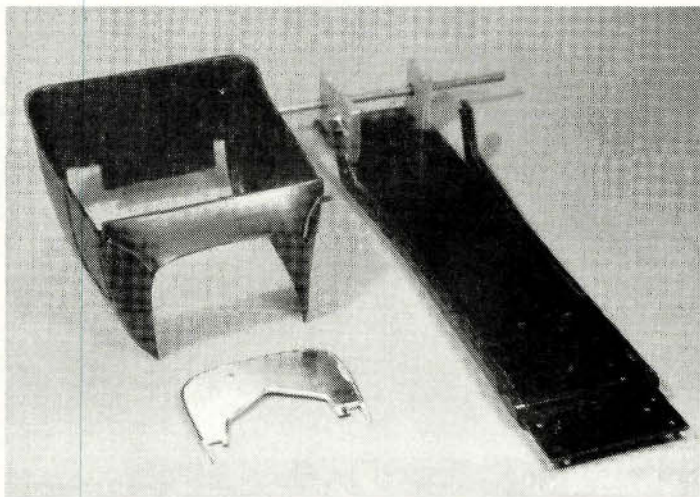
If you want to paint the body, do it before you permanently mount it to the chassis. With all its classy plating, you can leave the engine black, but the body literally begs for paint—maybe a wild metallic or candy color, or a deep solid color with hot flames or graphics!

THE REAL POWER

Install the electric-drive motor, the gears and the assemblies for the rear axle and front end according to the instructions. Mount the radio receiver and electronic speed controller on the chassis floor; they'll be hidden under the plastic kit interior floorboards. (You could use a me-



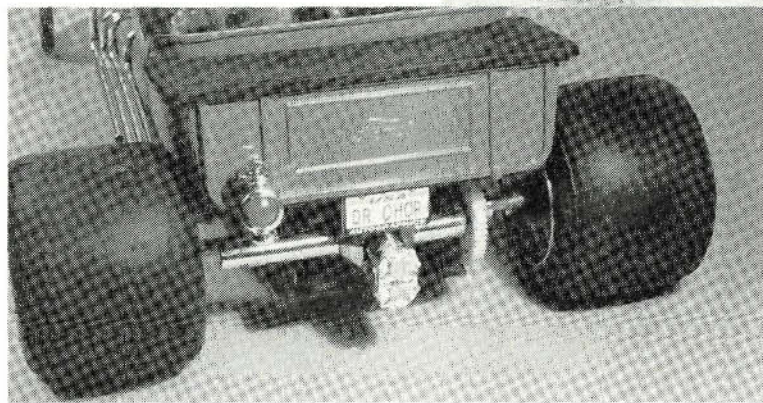
The interior fits snugly and neatly hides the R/C equipment.



Modify the kit's firewall so that it clears the Street Machine chassis. Note that the kit rails, when attached to the Advance chassis, are placed at the exact spacing required for scale build-up.

BUILD A T-Bucket

chanical speed controller and servo, but they won't fit under the floorboards.) Mount the steering servo in the suggested location, and carefully notch the radiator assembly so that it fits around



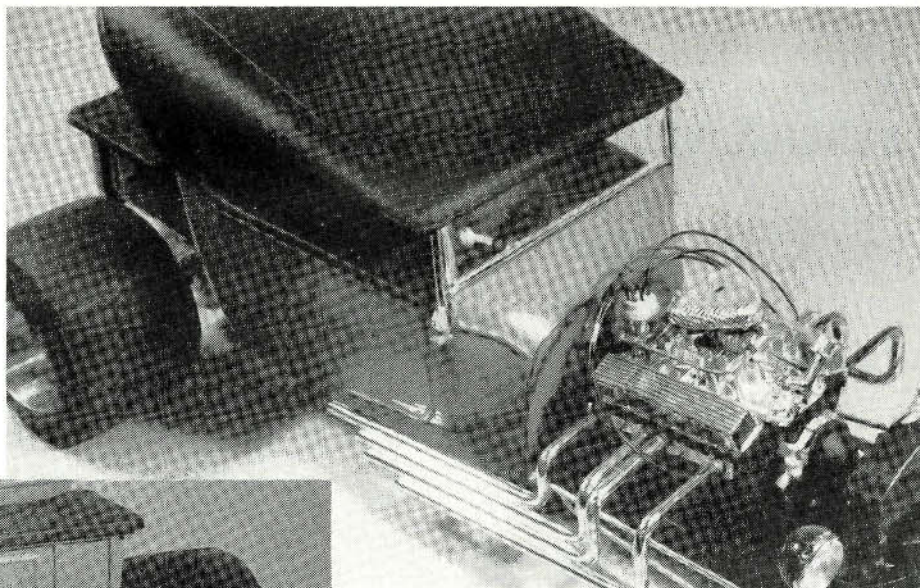
The rear-end details include a shortened scale axle housing.

the servo. It disguises the servo so that you can hardly see it. Route the steering-servo wiring harness along the inside of the frame rail back to the receiver, and mate the connectors to the receiver. A 5-cell sub-C Ni-Cd pack just fits in the pickup bed, and the wires are routed under the back of the bucket to the speed

controller. Now's the time to test the R/C functions—any changes can be made easily.

FINISHING TOUCHES

Once you've tested the radio, mount the Chevy engine onto the chassis with either silicone sealant or wood screws



The top adds a rakish appearance to finished street rod.

that come up through the bottom of the chassis and into a wooden block that's glued to the inside of the engine. Cement the scale dashboard, steering wheel and other interior parts to the seat/floor shell, and then drop the whole assembly into place. You won't have to attach it to anything.

The windshield snaps into place without glue, so it can pop off in a crash without being damaged. The windshield assembly is fragile, so be careful. To make the folding top (which doesn't really fold) removable, install a pair of small plastic pins that mate with holes drilled into the seat top, or glue it to the top of the seat so that it can be removed with the interior assembly.

You can use the remaining Monogram kit details, or you can create your own. Check out magazines like *Street Rodder* and *Rod and Custom* for some good ideas. Because the parts are so big, you can easily rework them. You could even add lights—too bad that V-8 engine doesn't run!

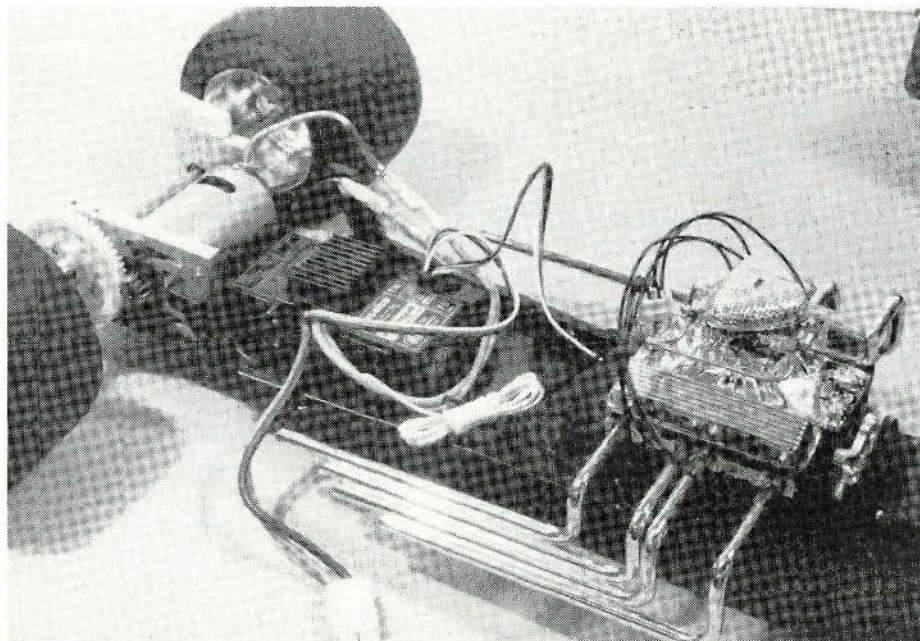
If you want to make new friends, don't run this car with other model cars—take it to where the real cars hang out, and go cruisin'!

**Here are the addresses of the companies mentioned in this article:*

Advance Engineering & Mfg. Co., P.O. Box 766, Woodland Park, CO 80866.

Monogram Models, Inc., 8601 Waukegan Rd., Morton Grove, IL 60053.

Total Performance, Inc., 400 S. Orchard St., Route 5, Wallingford, CT 06492. Tel: (203) 265-5667.



The speed controller and receiver installation details.

SCOPING OUT

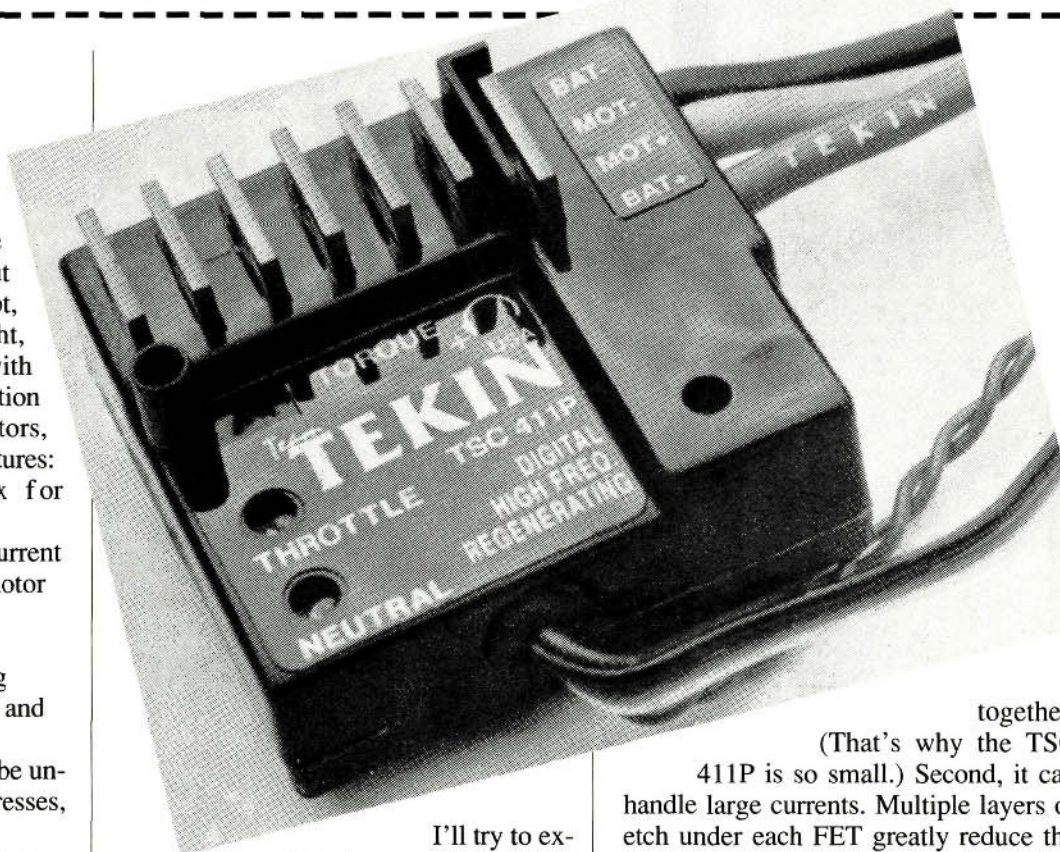
by JOHN RIST

TEKIN 411P

YOU'VE PROBABLY SEEN "hot," "new" and "trick" written about so many R/C racing products that the words have lost their meaning, but Tekin's new TSC 411P really is hot, new and "trick"! This small, light, racing speed controller comes with heat sinks, a screwdriver, an instruction book, tie-wraps, filter capacitors, mounting tape and decals, and it features:

- seven Megafet transistors: six for forward and one for brake
- monster wire to handle a large current
- high-frequency, linear-current motor drive
- regenerating battery recharge
- electronic BEC bypass switching
- multi-layer printed-circuit board and surface-mount components

Several words on this list might be unfamiliar to you. As the article progresses,



THE "SCOPING OUT" LAB

John Rist's lab consists of:

- an oscilloscope
- a digital voltmeter
- a resistor load bank
- a 6V 30-amp electricity supply
- a Pit Stop Radio servo/speed controller tester.

The oscilloscope is used to monitor the controller's output and to guarantee that it's fully on.

The digital voltmeter takes all the voltage-drop readings and verifies the reading on the current meter.

The resistor load bank consists of 40, 12-ohm, 5-watt power resistors, which can be switched on and off one at a time to vary the load between .6 amps and 20 amps.

In series with the resistors is a 25-amp Simpson current meter and a 1-percent .01-ohm resistor. By measuring the voltage drop across this resistor, the current-meter's reading can be double-checked. Of course, the lab power supply provides the test current.

I'll try to explain them and point out their advantages, but first, let's determine whether this Tekin product is a winner or a "dog." Specification claims are cheap unless you can back them up!

To check out a controller, I first remove the case. I was very curious to see whether the TSC 411P really had a "multi-layer printed-circuit board covered with surface-mount components." A few words of caution: I don't recommend that you open an electronic speed controller unless you've had experience working with miniature electronics.

The TSC 411P is an incredible example of miniature electronics—the type that's usually found only in computers and satellites!—and it does, indeed, have a multi-layer printed-circuit (pc) board. This type of board is made by bonding multiple layers of pc boards under high pressure and temperature, and then connecting all the inner layers to the outer layers by drilling and plating a pattern of holes.

The process is expensive, but it provides two big advantages: first, interconnecting circuits can be placed in the inner layers, so the components can be placed closer

together.

(That's why the TSC 411P is so small.) Second, it can handle large currents. Multiple layers of etch under each FET greatly reduce the resistance of the printed circuit between the FETs.

The heart of the TSC 411P is a 24-pin, custom, surface-mount, large-scale integrated chip. All that's printed on the top is "LSI Logic" (the chip manufacturer's name), "Tekin," a custom part number, a date code and "VER A." Tekin must have paid LSI a lot to produce a very complex, compact, custom chip for its TSC 411P. There was probably a prototype chip, and the production version is identified as "VER A."

This controller makes extensive use of surface-mount components—another space-age innovation. The legs of the parts are bent outward so that they run parallel to (and lie flat on) the surface of the pc board and therefore can be lap-soldered to the matching etch. (Usually, a part's legs are at right angles to the board.) Surface-mount parts provide an obvious advantage: because their legs don't pass through holes in the board, parts can be mounted on both sides.

All this high-tech construction is exciting to engineers, but hammer-handed throttle-jammers are more interested in

whether this baby is a new hot trick, or will just run hot and burn up. To find out, I headed to the "Scoping Out" lab to see how the real numbers compare to Tekin's advertised claims.

LAB TESTS

First, I reviewed the supplied instruction sheet, and I had only one complaint. The TSC 411 comes in two versions: the "S," which isn't scheduled for release until spring '91, has four large wires to connect the battery and motor; the "P" has only three. One installation drawing shows both setups. If you don't read the words that go with the picture, you could easily be confused by the number of wires.

The version I tested has three wires—red, black and blue. To set up this controller properly, connect the red wire to the positive (+) side of the battery, the black wire to the negative (-) side of the battery, and the blue wire to the negative (-) side of the motor. This leaves the positive (+) side of the motor without a connection. Use a separate piece of monster wire (supplied with the TSC 411P) to connect the positive (+) side of the motor to the positive (+) side of the battery.

The only other strange item was the torque-control pot. This is a current-limiting feature that can be used to restrict acceleration on slippery tracks. For my lab tests, I left this control on its maximum setting.

When testing a speed controller, I always take two voltage-drop measurements: with full-length wires (to determine the resistance of the controller "as supplied"), and at the 2-inch point on the wires (to provide a standard measurement for use in comparing controllers).

With the TSC 411P hooked up and 12 amps flowing, I measured a .08V drop across the controller. This gives a calculated resistance of .0066 ohm. The second measurement—taken at the 2-inch wire point—yielded a .06V drop, or a calculated resistance of .005 ohm.

These readings revealed two interesting points. The TSC 411P has a 2-inch-

(Continued on page 132)

EDITORIAL OPPORTUNITY

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SCOPING OUT

point voltage drop that's as low as any 7-FET controller I've ever measured, and the difference between the end-to-end and the 2-inch measurements was almost unmeasurable. I'm sure this is because the TSC 411P has true monster-wire leads and there were no connectors in the end-to-end test. As I've said many times, good connectors and monster wire are the cheapest "trick" parts you can buy.

Next, I ran my "let-it-cook" test. I jacked the test current up to 18 amps. Although I did install the heat sink, I didn't provide any cooling air. I let the controller cook for 15 minutes and then felt the heat sink and the controller. They were warm, but not overly hot, considering it was 95 degrees (in the shade!) the day I was testing this controller.

You should always use the heat sinks when running the new speed controllers with automatic thermal shut-down, because most have only one thermal-sensing FET. When this FET gets too hot, it clamps the control signal to ground, shutting off all the FETs. If one of the non-thermal-sensing FETs overheats, the heat sink transfers the heat to the Tempfet so that it can do its job and protect the other FETs. Although the 411P has an electronic device that monitors the temperature of the FETs more accurately than a single Mosfet, it still requires the use of the heat sink.

My final lab test was the "dead-short," in which I check whether the thermal shutdown circuit works. I lay the dead short across the speed controller, and the ammeter read 41 amps. The TSC 411P took this abuse for 3.5 minutes and went into thermal shutdown. After a 1-minute "cool down," it was able to supply full power again. With the lab tests over, it was time for fun!

ROAD TESTS

I put the TSC 411P in my Turbo Ultima, which I was getting ready for an off-road, dirt-track race. With a handful of charged

6-cell packs, a stock motor and some very tall gearing, I headed to the track for some test runs.

The TSC 411P was *very* smooth—especially at low speeds. A quick check of my lab-test notes revealed that the TSC 411P switches 40 to 50 times faster than a normal speed controller. If your motor is turning at 6,000rpm, the armature rotates at 100 turns per second. Most speed controllers switch at a rate of 60 cycles per second. At this slow speed, "juice" is fed to the motor less than once per revolution, and this causes gear-grinding vibration.

a 350-degree turn on the back side of the track!)

A running-time test conducted by racers at my local track revealed that the TSC 411P provides runs that are 20 to 30 seconds longer when geared to dump at around 4 minutes. The Tekin instruction book gives two reasons for the longer running times. First, the batteries are recharged when the brakes are applied. When the trigger is released, a speeding car pushes the motor, which then acts as a generator and produces a large voltage that's capable of recharging the battery. As well as I can figure, a diode is built into

each of the six forward FETs. These diodes provide a path back to the battery and permit the motor (which is now acting as the generator) to put some charge back into it.

Second, motor current is regenerated while you're driving. I spoke with the engineers at Tekin, who provided this explanation of regeneration: when you run at less than full throttle, the speed controller switches on and off at a high rate (2,700 cycles per second). When the controller is on, battery current flows through the motor and causes it to turn. When the controller is off, the motor acts as a generator.

In a normal speed controller, this generator action is harmful, because it produces a high-voltage spike that causes arcing, which burns the armature. In the TSC 411P,

the "off" time is very short because of the high-speed switching. This short "off" time allows less of the magnetic field to collapse and produces less arcing. The second innovation is that there's another set of diodes in the FETs, and they allow the current to keep flowing in the motor.

In my lab, I compared the battery and motor currents at half throttle. With 10 amps of current flowing into the motor, only 5.6 amps flowed out of the battery. The higher motor current can be accounted for when you realize that it's the sum of the battery current (5.6 amps) that flows when the FETs are on and the motor back-voltage current (caused by the motor act-

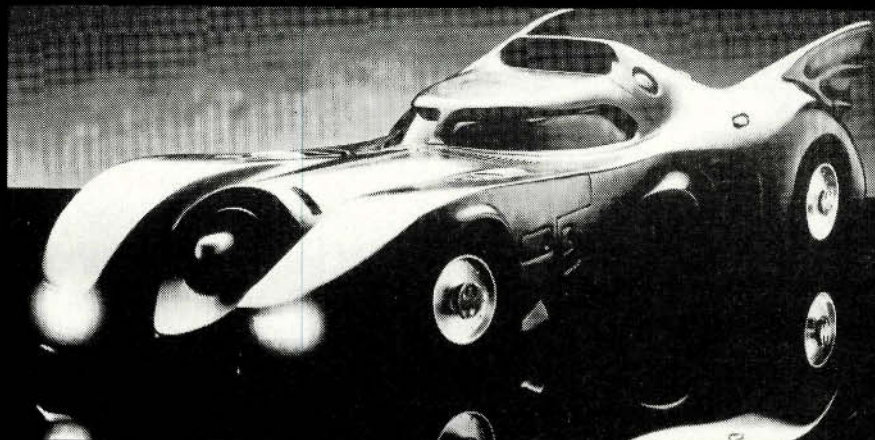
TEKIN TSC 411P	
DIMENSIONS:	
Height	0.75 inch
Width	1.6 inches
Length	1.4 inches
Weight (with wires)	1.5 ounces
TUNING:	
Access to Controls	Good
Ease of Adjustment	Fair
PRICE:	
Suggested Retail	\$170
Warranty	120 days
ELECTRICAL: (Manufacturer's Specs)	
Max. Voltage	13.75 volts
Min. Voltage	5 volts
Max. Current	1050 amps
Continuous Current	Not listed
Resistance	0.0025 ohm
TEST PARAMETERS:	
Voltage	6 volts
Current	12 amps
Voltage Drop to end of wires	0.08 volt
Voltage Drop, 2-inch point	0.06 volt
Resistance to end of wires*	0.0066 ohm
Resistance, 2-inch point*	0.005 ohm
BEC Output, 6-cell battery	5.50 volts
*Calculated Resistance = Voltage Drop / Current	
COMMENTS:	
The TSC 411P speed controller is a totally new weapon in Tekin's arsenal. This small, but <i>hot</i> , performer uses space-age technology such as multi-layer printed-circuit boards and custom surface-mount components. Tekin's new high-speed switching FETs have three major advantages: they provide smooth power at low speeds; they eliminate much of the arcing that destroys armatures; and they provide regenerating battery recharging. If you're looking for the "king" of 7-FET racing speed controllers, "test-drive" the TSC 411P.	

A slow switching rate causes another problem: the magnetic field in the motor has time to collapse completely between pulses. This creates a large "back voltage," which causes the armature to arc and spark. The TSC 411P seems to switch at a 2,700-cycle-per-second rate, while the braking side switches at 5,400 cycles per second! This faster rate provides much smoother power transfer and braking, and this protects the gears and greatly reduces armature arcing and sparking.

The TSC 411P's low "on" resistance was evident in the car's blinding acceleration and hot top speeds. Braking was adequate. (The car needed it to get around

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ing as a generator) that flows when the FETs are off.

You don't really get a two-for-one boost, because the motor-generated current doesn't provide any push to the wheels. It does, however, control the collapse of the magnetic field in the motor. When the FETs switch back on, it takes less time for the battery to get the field back up to full strength. Here lies the battery savings: because it takes less time to get the magnetic field back up to full strength, a lower throttle setting provides enough power to run at a given speed.

I adjusted the torque-control pot from its wide-open position to its minimum setting, and the car ran as if the battery were about to dump. It had no zip at all! With a range of "blinding acceleration" to "no zip," you should be able to find a setting that works for any track.

My son Joe and I entered the big off-road race at the local track, and we easily came in 1st in all the heat races. A bad start in the A-Main left us in last place, but because of the TSC 411P's "driveability," Joe was able to "reel in" all but one of the cars! Score a big 2nd-place finish in the A-Main for the TSC 411P on its first time out!

There you have it! Tekin's TSC 411P is the most technically advanced high-performance speed controller that I've tested in a long time. Its smallness and lightness made it a snap to install, and its performance rivals that of any premium-grade 7-FET speed controller. You'll notice the smoothness and precise control provided by the high-speed switching the first time you squeeze the trigger!

So that you don't think I've been bribed by Tekin, I *did* find a small problem. The three-wire setup leaves a gaping hole in the case where the fourth wire exits on other models. Tekin provides plugs to seal the adjustment holes, but it ignores the hole left by the missing wire! Nevertheless, if you're looking for a big step up in performance that comes in a small package, check out the all-new TSC 411P.

**Here's the address of the company featured in this article:*

Tekin Electronics, 970 Calle Negocio, San Clemente, CA 92672.

Ballistic Batteries

(SCE)

TEAM 195+ = \$11.50 ea
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(SCR)

TEAM 170+ = \$9.00 ea
RACE 160-169 = \$7.50 ea
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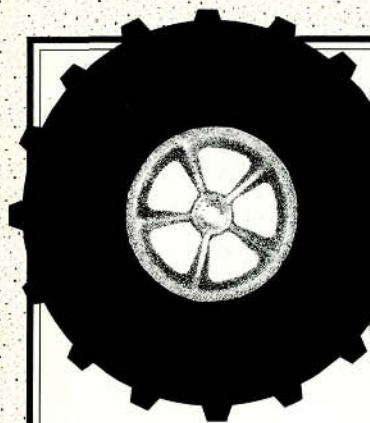
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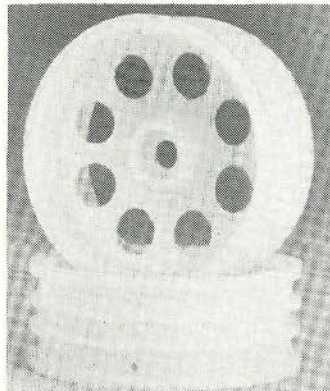
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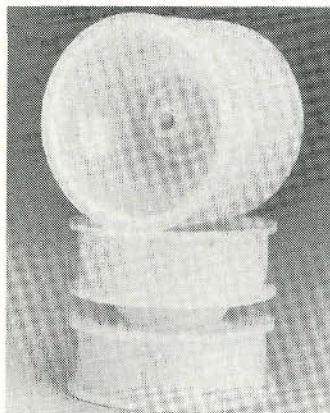
OFF-ROAD WHEEL ROUND-UP

A tire is only as good as the wheel it runs on—end of story! I don't care if you have handmade rubber super-spikes on which all the spikes have been trimmed to 164¹/₂ micrometers by Master Masami himself! If the wheel wobbles, the car bobbles! Many aspiring racers overlook the necessity of having wheels that run true, but don't fall victim to this oversight. Pick your wheels wisely! Here are 77 pair of wheels from which to choose. Have fun.

CRP

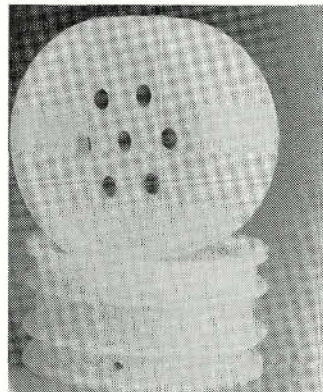


Manufacturer CRP
Name Front wheels
Part no. 4111
Diameter 2.13 inches (54.12mm)
Width86 inch (22.04mm)
Bead Width2 inch (5.12mm)
Weight 4 ounce
Fits Fox, Wild One
Price \$4.99

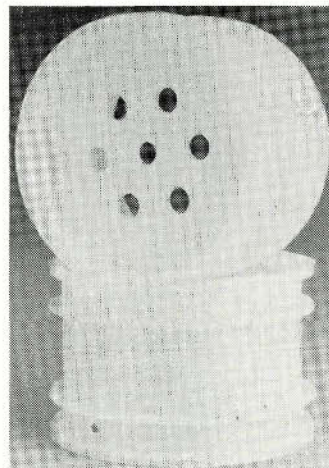


Manufacturer CRP
Name One-piece rear wheels
Part no. 4113

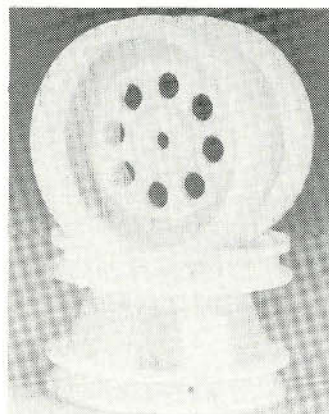
Diameter 1.7 inches (43.17mm)
Width 1.49 inches (37.86mm)
Bead Width51 inch (13.06mm)
Weight6 ounce
Fits RC10
Price \$6.99



Manufacturer CRP
Name Front wheels
Part no. 4116
Diameter 2.03 inches (51.48mm)
Width 1.11 inches (28.31mm)
Bead Width23 inch (5.86mm)
Weight41 ounce
Fits Hot Shot, Super Shot and other
Tamiya 4WD cars
Price \$6.99

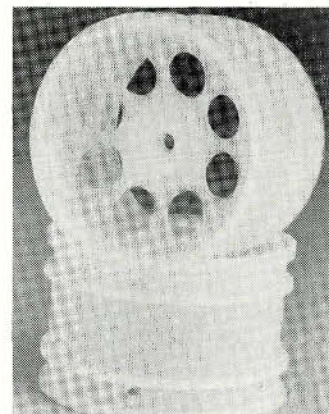


Manufacturer CRP
Name Rear wheels
Part no. 4117
Diameter 2.11 inches (53.58mm)
Width 1.43 inches (36.25mm)
Bead Width23 inch (5.78mm)
Weight45 ounce
Fits Hot Shot, Super Shot and other
Tamiya 4WD cars
Price \$6.99

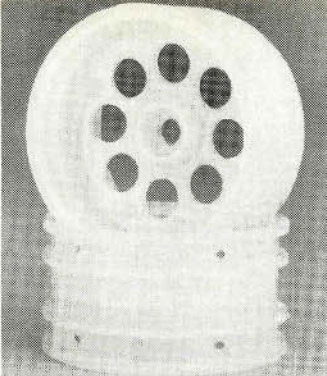


Manufacturer CRP
Name Kyosho wheels

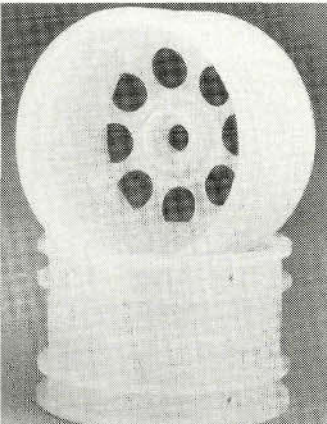
Part no. 4118
Diameter 2.02 inches (51.17mm)
Width 1.37 inches (34.79mm)
Bead Width21 inch (5.35mm)
Weight43 ounce
Fits Kyosho or other hexagonal hubs
Price \$6.99



Manufacturer CRP
Name Rear wheels
Part no. 4119
Diameter 1.99 inches (50.53mm)
Width 1.41 inches (35.82mm)
Bead Width21 inch (5.39mm)
Weight45 ounce
Fits Fox, Falcon, Striker, Wild One
Price \$6.99

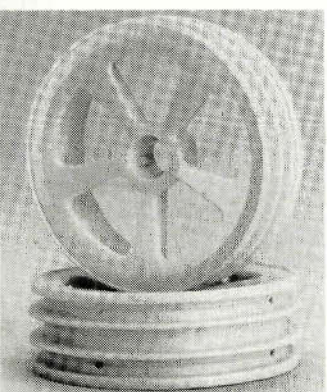


Manufacturer CRP
Name Wide front wheels
Part no. 4122
Diameter 2.03 inches (51.57mm)
Width 1.18 inches (30.1mm)
Bead Width21 inch (5.43mm)
Weight45 ounce
Fits 2WD cars with 5x11 bearings
Price \$6.99

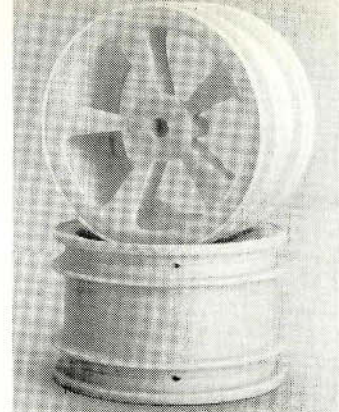


Manufacturer CRP
Name Wide front wheels
Part no. 4123
Diameter 2.02 inches (51.5mm)
Width 1.4 inches (35.76mm)
Bead Width21 inch (5.36mm)
Weight48 ounce
Fits 2WD cars with 5x11 bearings
Price \$6.99

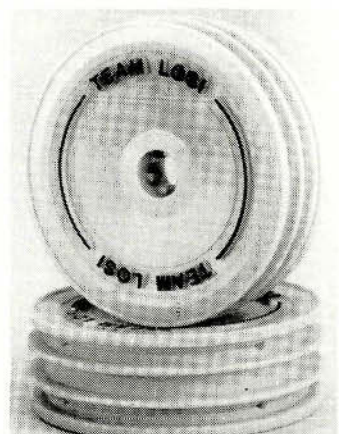
LOSI



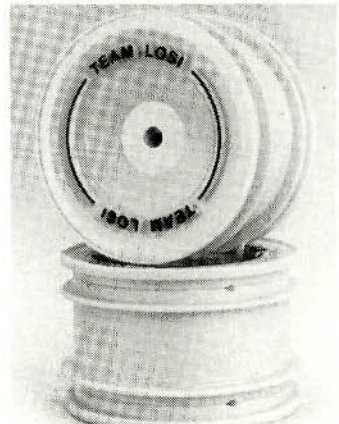
Manufacturer Team Losi
Name Five-star front
Part no. 7001
Diameter 2.10 inches (53.47mm)
Width77 inch (19.49mm)
Bead Width15 inch (3.80mm)
Weight43 ounce
Fits JR-X2
Price \$5



Manufacturer Team Losi
Name Five-star rear
Part no. 7101
Diameter 2.14 inches (54.36mm)
Width 1.40 inches (34.90mm)
Bead Width21 inch (5.44mm)
Weight53 ounce
Fits JR-X2
Price \$5

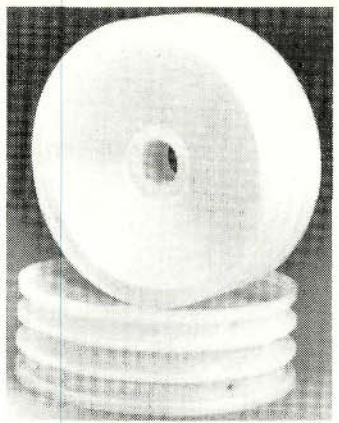


Manufacturer Team Losi
Name Front logo rims
Part no. A-7010
Diameter 2.13 inches (54.11mm)
Width59 inch (15mm)
Bead Width15 inch (3.80mm)
Weight47 ounce
Fits JR-X2
Price \$5

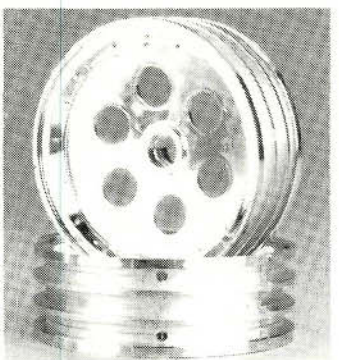


Manufacturer Team Losi
Name Rear logo rims
Part no. A-7110
Diameter 1.97 inches (50mm)
Width 1.20 inches (30.48mm)
Bead Width21 inch (5.43mm)
Weight59 ounce
Fits JR-X2
Price \$5

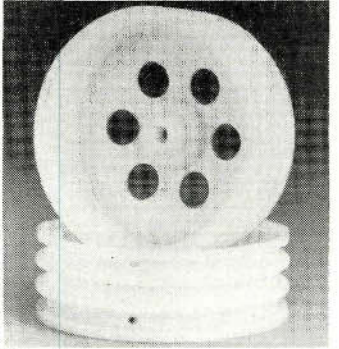
PRO-LINE



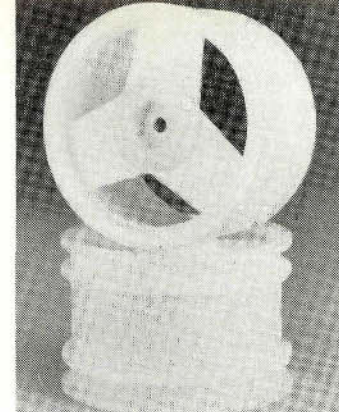
Manufacturer Pro-Line
Name Front
Part no. 2531
Diameter 2.16 inches (54.73mm)
Width82 inch (20.85mm)
Bead Width15 inch (4.03mm)
Weight51 ounce
Fits JR-X2
Price \$7.95



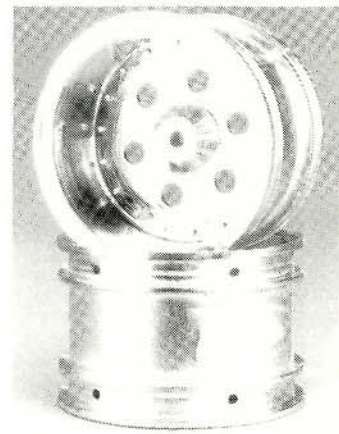
Manufacturer Pro-Line
Name Front chrome
Part no. 2523C
Diameter 2.18 inches (55.26mm)
Width82 inch (20.86mm)
Bead Width15 inch (3.96mm)
Weight4 ounce
Fits RC10 and Kyosho
Price \$8.95



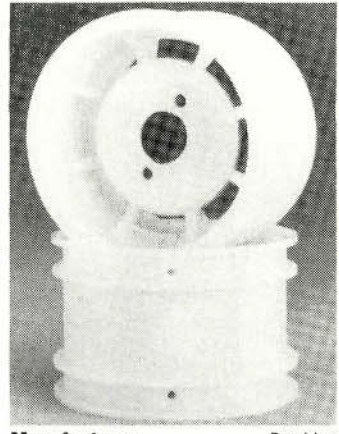
Manufacturer Pro-Line
Name Kyosho/Tamiya front wheel
Part no. 2530
Diameter 2.17 inches (55.13mm)
Width79 inch (20.38mm)
Bead Width15 inch (3.93mm)
Weight41 ounce
Fits Kyosho or Tamiya 4WD
Price \$5.95



Manufacturer Pro-Line
Name Tamiya rear wheel
Part no. 2521
Diameter 2 inches (51.05mm)
Width 1.43 inches (36.54mm)
Bead Width21 inch (5.5mm)
Weight56 ounce
Fits Tamiya 4WD
Price \$5.95

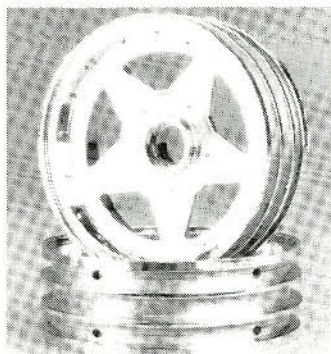


Manufacturer Pro-Line
Name Rear chrome
Part no. 2519
Diameter 2 inches (52.04mm)
Width 1.45 inches (36.71mm)
Bead Width21 inch (5.53mm)
Weight57 ounce
Fits RC10 and early Kyosho
Price \$8.95

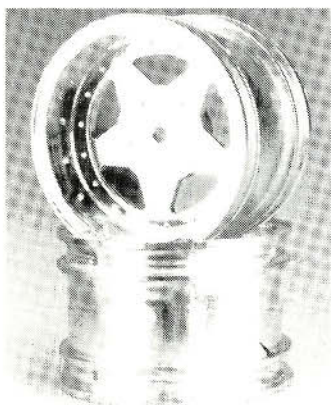


Manufacturer Pro-Line
Name Yokomo wheel
Part no. 2520
Diameter 2.02 inches (51.26mm)
Width 1.43 inches (36.34mm)
Bead Width22 inch (5.58mm)
Weight51 ounce
Fits Yokomo rear
Price \$5.95

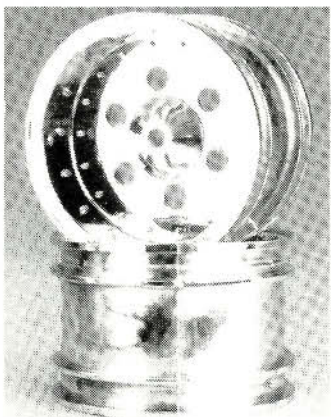
PRO-LINE



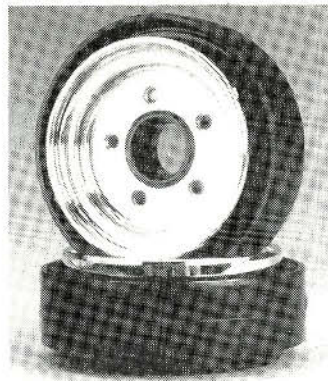
Manufacturer Pro-Line
Name Front chrome three-piece
Part no. 2522C
Diameter 2.16 inches (54.93mm)
Width82 inch (20.87mm)
Bead Width16 inch (4.15mm)
Weight40 ounce
Fits Tamiya fronts
Price \$8.95



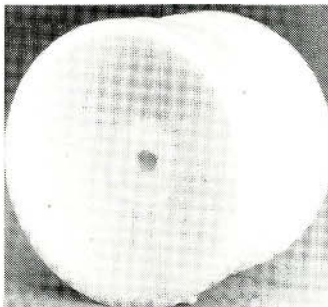
Manufacturer Pro-Line
Name Rear chrome
Part no. 2517C
Diameter 2 inches (50.87mm)
Width 1.44 inches (36.79mm)
Bead Width21 inch (5.39mm)
Weight54 ounce
Fits Tamiya rears
Price \$8.95



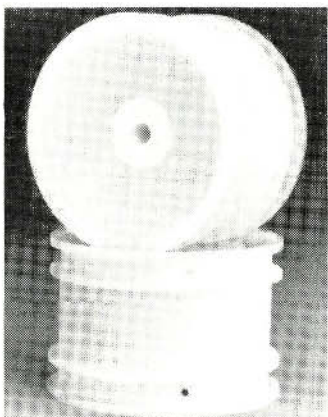
Manufacturer Pro-Line
Name Rear chrome
Part no. 2518C
Diameter 2 inches (50.98mm)
Width 1.44 inches (36.65mm)
Bead Width21 inch (5.45mm)
Weight55 ounce
Fits Kyosho and late-model Tamiya
Price \$8.59



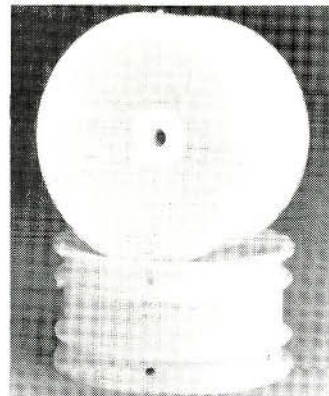
Manufacturer Pro-Line
Name Front 4WD narrow dish
Part no. 2503
Diameter 1.57 inches (40.03mm)
Width77 inch (19.75mm)
Bead Width1 inch (3.3mm)
Weight51 ounce
Fits RC10
Price \$6.50



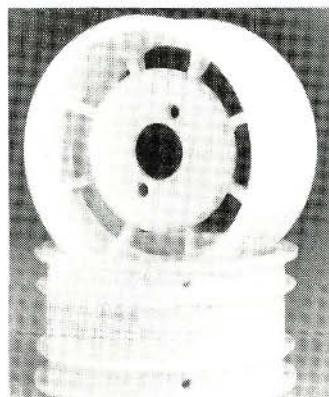
Manufacturer Pro-Line
Name Rear dish
Part no. 2560
Diameter 2.01 inches (51.22mm)
Width 1.39 inches (35.41mm)
Bead Width22 inch (5.63mm)
Weight59 ounce
Fits JR-X2
Price \$5.95



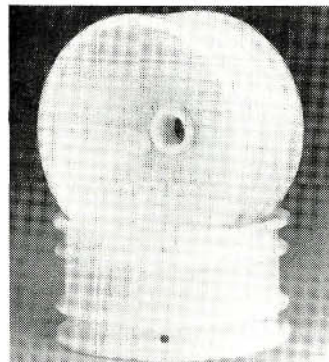
Manufacturer Pro-Line
Name Rear wheel
Part no. 2532
Diameter 2 inches (50.95mm)
Width 1.44 inches (36.77mm)
Bead Width21 inch (5.54mm)
Weight62 ounce
Fits JR-X2
Price \$5.95



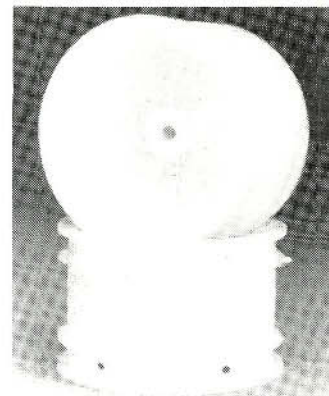
Manufacturer Pro-Line
Name Front 4WD narrow dish
Part no. 2549
Diameter 2.02 inches (51.35mm)
Width 1.14 inches (28.84mm)
Bead Width22 inch (5.55mm)
Weight49 ounce
Fits Kyosho 4WD
Price \$6.95



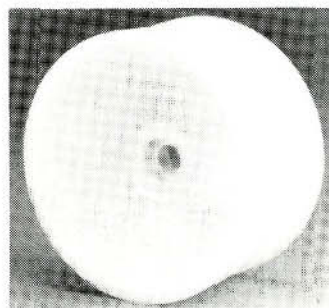
Manufacturer Pro-Line
Name Front narrow racing wheel
Part no. 2550
Diameter 2.01 inches (51.07mm)
Width 1.12 inches (28.58mm)
Bead Width22 inch (5.61mm)
Weight39 ounce
Fits Yokomo
Price \$6.95



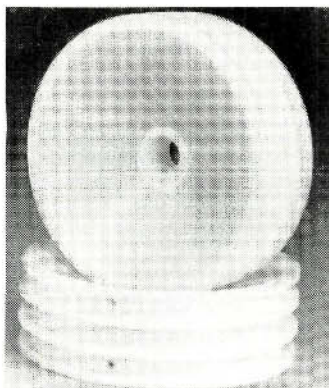
Manufacturer Pro-Line
Name Racing wheel with dirt shield
Part no. 2557
Diameter 2.01 inches (51.08mm)
Width 1.13 inches (28.70mm)
Bead Width22 inch (5.64mm)
Weight56 ounce
Fits RC10 and Kyosho fronts
Price \$6.95



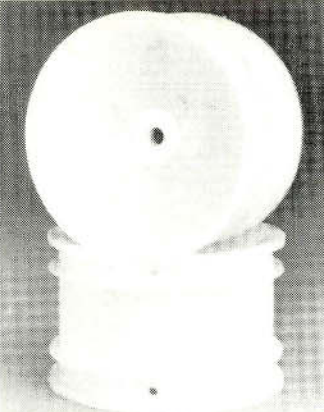
Manufacturer Pro-Line
Name Racing dish wheel
Part no. 2558
Diameter 2.01 inches (51.26mm)
Width 1.3 inches (35.32mm)
Bead Width 1.38 inches (35.2mm)
Weight64 ounce
Fits RC10
Price \$6.95



Manufacturer Pro-Line
Name Racing wheel with dirt shield
Part no. 2559
Diameter 2.02 inches (51.34mm)
Width 1.14 inches (29.07mm)
Bead Width22 inch (5.72mm)
Weight51 ounce
Fits JR-X2 fronts
Price \$6.95

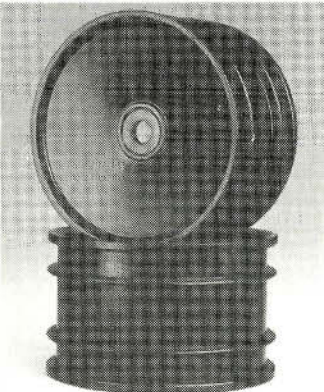


Manufacturer Pro-Line
Name Front racing wheel
Part no. 2566
Diameter 2.16 inches (55.06mm)
Width75 inches (19.1mm)
Bead Width16 inches (4.06mm)
Weight51 ounce
Fits RC10 and Kyosho
Price \$5.95

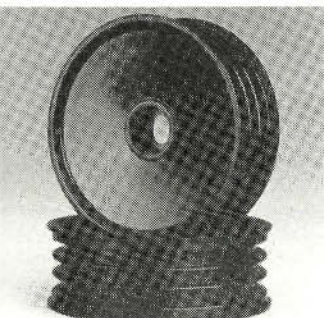


Manufacturer Pro-Line
Name Racing wheel with dirt shield
Part no. 2561
Diameter 2.01 inches (51.18mm)
Width 1.38 inches (35.19mm)
Bead Width22 inches (5.59mm)
Weight58 ounce
Fits Kyosho and late-model Tamiya
Price \$6.95

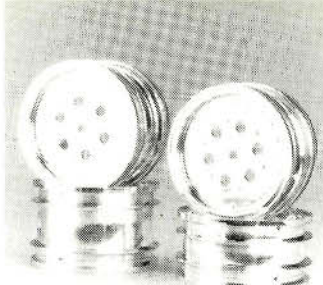
TAMIYA



Manufacturer Tamiya
Name Wide dish wheels
Part no. 53058
Diameter 2 inches (51.8mm)
Width 1.3 inches (33.9mm)
Bead Width2 inch (6mm)
Weight66 ounce
Fits Late-model Tamiya, Kyosho
Price \$5.80



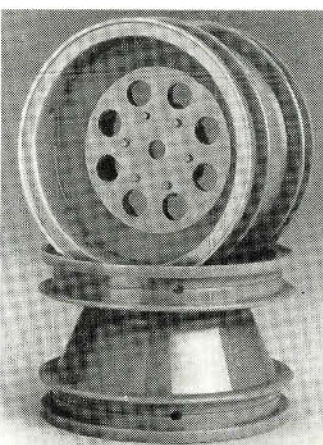
Manufacturer Tamiya
Name Front dish wheels
Part no. 53057
Diameter 1.7 inches (44.7mm)
Width7 inch (18.8mm)
Bead Width1 inch (3.3mm)
Weight43 ounce
Fits Tamiya or other 5x11 bearing cars
Price \$5.50



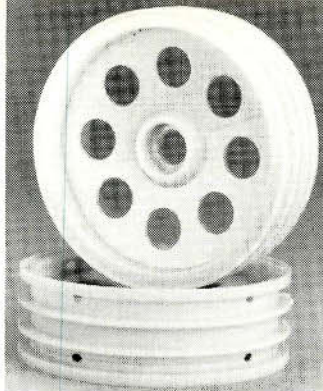
Manufacturer Tamiya
Name Hotshot plated wheel
Part no. 50266
Diameter 2 inches (50.7mm)
Width 1.4 inches (35.9mm)
Bead Width 2 inch (5.9mm)
Weight52 ounce
Fits Hotshot
Price \$14.30



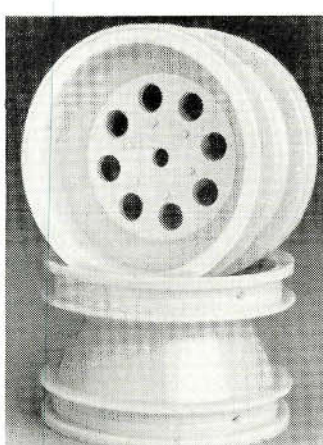
Manufacturer Tamiya
Name Thundershot plated wheel
Part no. 50343
Diameter 1.8 inches (48mm)
Width 1.4 inches (35.7mm)
Bead Width 2 inch (5.1mm)
Weight56 ounce
Fits Thundershot
Price \$4.50



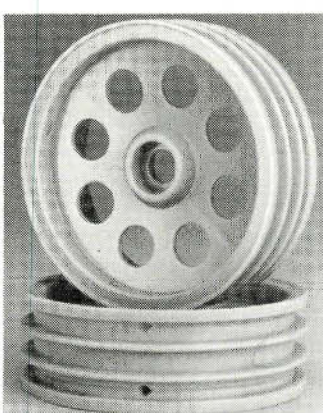
Manufacturer Tamiya
Name Day-Glo wheel set
Part no. 49024
Diameter 2 inches (51.2mm)
Width 1.4 inches (36.1mm)
Bead Width 2 inch (5.8mm)
Weight44 ounce
Fits Tamiya rear 2WD cars
Price \$5.50



Manufacturer Tamiya
Name Front Day-Glo wheel set
Part no. 49022
Diameter 2.1 inches (55.2mm)
Width7 inch (20.1mm)
Bead Width1 inch (3.9mm)
Weight39 ounce
Fits Tamiya and other 5x11 bearing cars
Price \$5.50



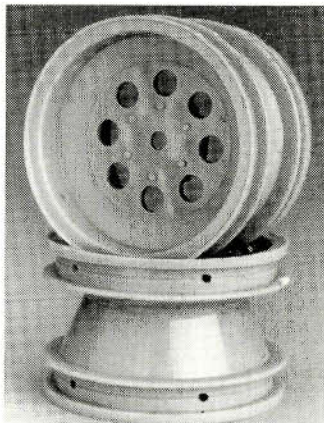
Manufacturer Tamiya
Name 2WD rear Day-Glo wheel set
Part no. 49025
Diameter 2 inches (51.3mm)
Width 1.4 inches (36.1mm)
Bead Width2 inch (5.9mm)
Weight44 ounce
Fits Tamiya
Price \$6.50



Manufacturer Tamiya
Name 2WD front Day-Glo wheel set
Part no. 49023
Diameter 2.18 inches (55.43mm)
Width79 inch (20.1mm)
Bead Width17 inch (4.22mm)
Weight4 ounce
Fits Tamiya and other 5x11 bearing cars
Price \$5.50

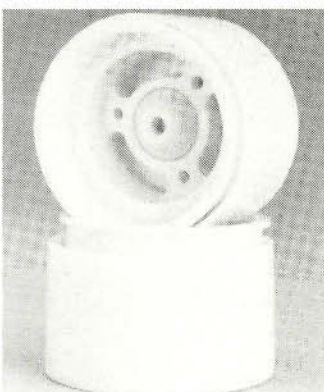


Manufacturer Tamiya
Name 2WD front
Part no. 49021
Diameter 2.18 inches (55.43mm)
Width79 inch (20.1mm)
Bead Width17 inch (4.22mm)
Weight4 ounce
Fits Tamiya and other 5x11 bearing cars
Price \$5.50



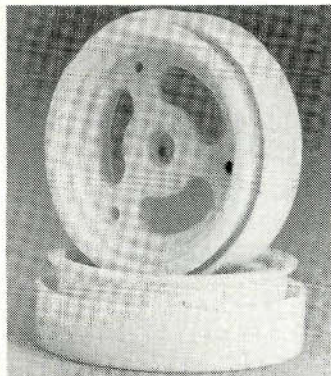
Manufacturer Tamiya
Name 2WD rear Day-Glo wheel set
Part no. 49026
Diameter 2.02 inches (51.48mm)
Width 1.43 inches (36.34mm)
Bead Width22 inch (5.73mm)
Weight43 ounce
Fits Tamiya
Price \$6.50

TEAM ASSOCIATED

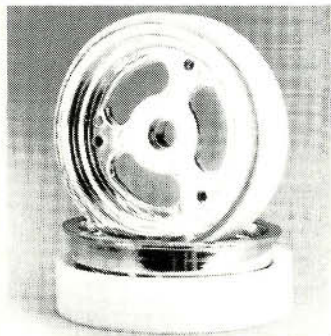


Manufacturer Team Associated
Name Rear rims with screws
Part no. 6800
Diameter 1.68 inches (42.83mm)
Width 1.34 inches (33.97mm)
Bead Width44 inches (11.21mm)
Weight7 ounce
Fits RC10
Price \$6

TEAM ASSOCIATED



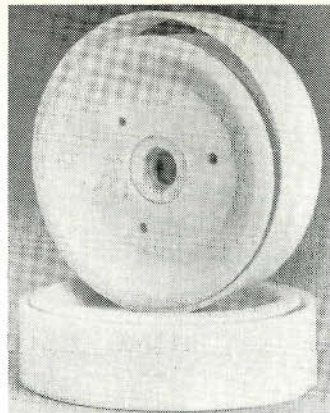
Manufacturer Team Associated
Name Front three-piece wheel
Part no. 6850
Diameter 1.91 inches (48.53mm)
Width72 inches (18.31mm)
Bead Width27 inches (6.98mm)
Weight51 ounce
Fits RC10 front
Price \$4



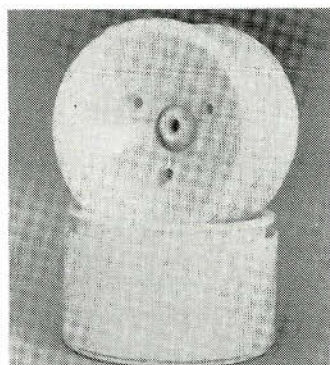
Manufacturer Team Associated
Name Front rims chrome
Part no. 6851
Diameter 1.92 inches (48.7mm)
Width73 inches (18.58mm)
Bead Width26 inch (6.52mm)
Weight57 ounce
Fits RC10
Price \$7



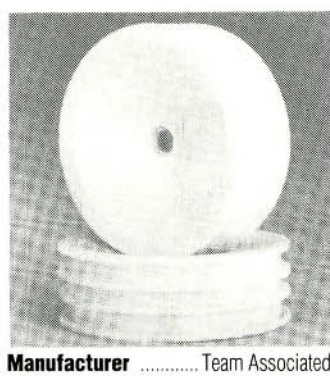
Manufacturer Team Associated
Name Rear rims chrome
Part no. 6801
Diameter 1.68 inches (42.9mm)
Width 1.34 inches (34.11mm)
Bead Width44 inches (11.33mm)
Weight74 ounce
Fits RC10 rear
Price \$11



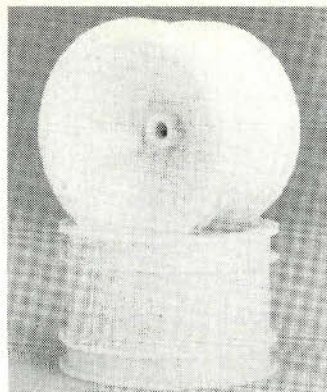
Manufacturer Team Associated
Name Three-piece fronts
Part no. 6854
Diameter 2.13 inches (54.2mm)
Width74 inches (19.07mm)
Bead Width24 inches (6.18mm)
Weight63 ounce
Fits RC10
Price \$4



Manufacturer Team Associated
Name Three-piece rears
Part no. 6804
Diameter 2 inches (50.75mm)
Width 1.38 inches (35.02mm)
Bead Width23 inch (5.83mm)
Weight71 ounce
Fits RC10
Price \$6



Manufacturer Team Associated
Name Front TQ rims
Part no. 6852
Diameter 54.22 inches (2.13mm)
Width 19.37 inches (.76mm)
Bead Width2 inch (5.1mm)
Weight38 ounce
Fits RC10
Price \$4



Manufacturer Team Associated
Name Rear TQ rims
Part no. 6802
Diameter 1.38 inches (35.12mm)
Width 1.38 inches (35.12mm)
Bead Width23 inch (5.91mm)
Weight51 ounce
Fits RC10
Price \$5.50

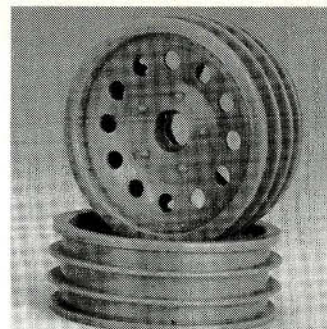
TRAXXAS



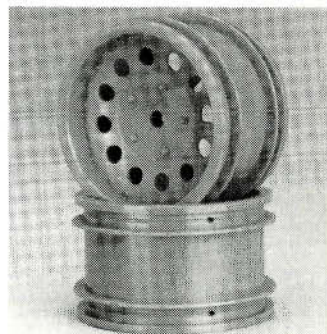
Manufacturer Traxxas
Name Wheels, natural
Part no. 1775
Diameter 2.13 inches (54.32mm)
Width86 inch (21.96mm)
Bead Width19 inch (4.94mm)
Weight49 ounce
Fits Traxxas fronts
Price \$3



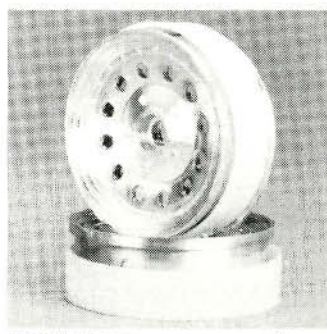
Manufacturer Traxxas
Name Wheels, natural (rear)
Part no. 1774
Diameter 2.13 inches (54.08mm)
Width 1.42 inches (36.09mm)
Bead Width19 inch (5.06mm)
Weight68 ounce
Fits Traxxas
Price \$4



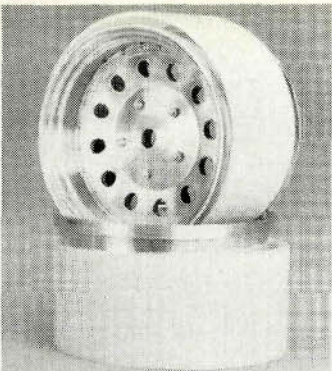
Manufacturer Traxxas
Name Wheels, hot pink
Part no. 1773
Diameter 2.15 inches (54.55mm)
Width86 inch (22.03mm)
Bead Width19 inch (4.96mm)
Weight5 ounce
Fits Traxxas or other 5x11 bearing cars
Price \$4



Manufacturer Traxxas
Name Wheels, hot pink (rear)
Part no. 1772
Diameter 2.14 inches (54.31mm)
Width 1.42 inches (36.16mm)
Bead Width19 inch (4.8mm)
Weight67 ounce
Fits Traxxas
Price \$5

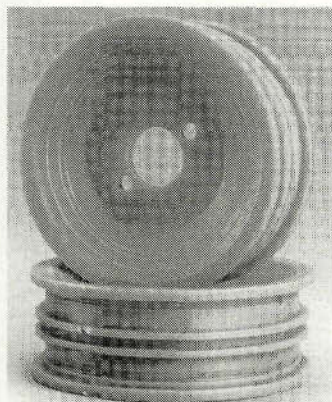


Manufacturer Traxxas
Name TRX-10 Bullet
Part no. 1610
Diameter 2.18 inches (55.42mm)
Width83 inch (21.2mm)
Bead Width31 inch (7.85mm)
Weight92 ounce
Fits Kyosho or early-model Traxxas
Price \$4.50

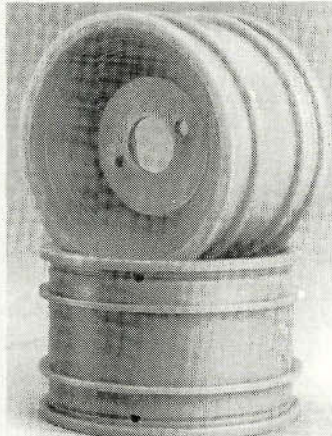


Manufacturer Traxxas
Name Three-piece rears
Part no. 1610-R
Diameter 2.30 inches (58.48mm)
Width 1.42 inches (36.10mm)
Bead Width 1.17 inches (29.75mm)
Weight 92 ounce
Fits Bullet/Radiator
Price \$4.50

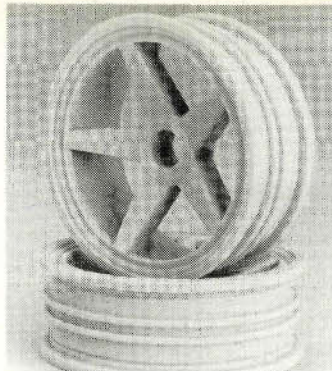
TRINITY



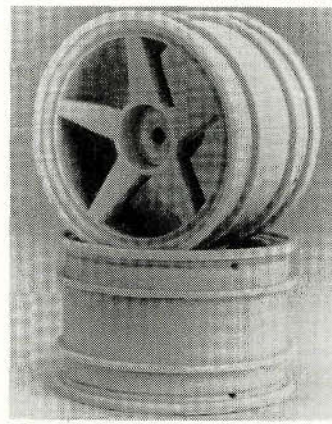
Manufacturer Trinity
Name Pink front wheel
Part no. 7155
Diameter 1.97 inches (50mm)
Width82 inches (20.66mm)
Bead Width23 inch (5.85mm)
Weight35 ounce
Fits Yokomo and Dominator
Price \$6



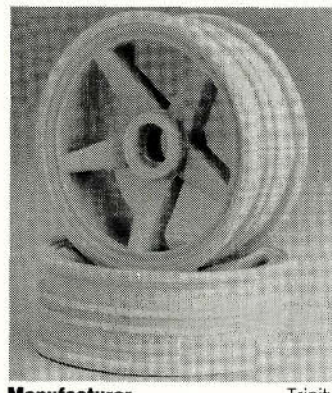
Manufacturer Trinity
Name Pink rear wheel
Part no. 7158
Diameter 2.01 inches (51.1mm)
Width 1.38 inches (35.23mm)
Bead Width26 inch (6.68mm)
Weight47 ounce
Fits Yokomo and Dominator
Price \$6



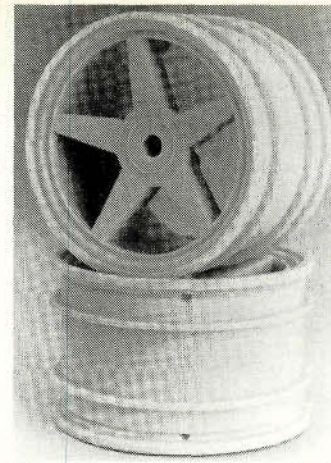
Manufacturer Trinity
Name Momo star wheel
Part no. 7130
Diameter 2.02 inches (51.42mm)
Width84 inches (21.26mm)
Bead Width23 inch (5.96mm)
Weight43 ounce
Fits RC10 fronts
Price \$6



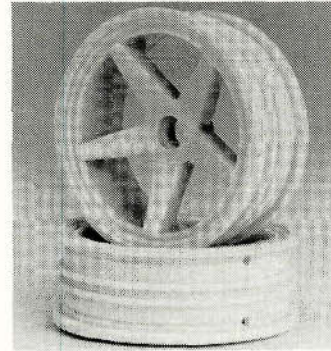
Manufacturer Trinity
Name Rear wheel
Part no. 7131
Diameter 2.04 inches (51.92mm)
Width 1.4 inches (35.73mm)
Bead Width27 inch (6.87mm)
Weight62 ounce
Fits RC10 rear
Price \$6



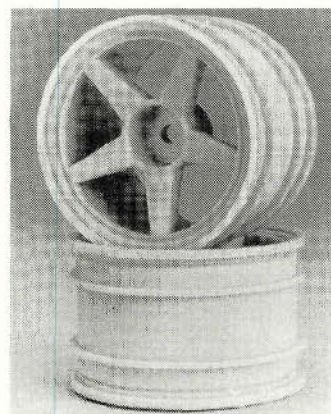
Manufacturer Trinity
Name Momo star wheel
Part no. 7126
Diameter 2.03 inches (51.65mm)
Width82 inches (21mm)
Bead Width23 inch (5.9mm)
Weight46 ounce
Fits JR-X2 fronts
Price \$6



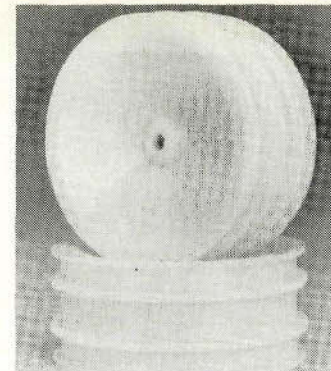
Manufacturer Trinity
Name Momo star wheel
Part no. 7127
Diameter 2.05 inches (52.13mm)
Width 1.41 inches (35.9mm)
Bead Width27 inch (6.95mm)
Weight67 ounce
Fits JR-X2 rears
Price \$6



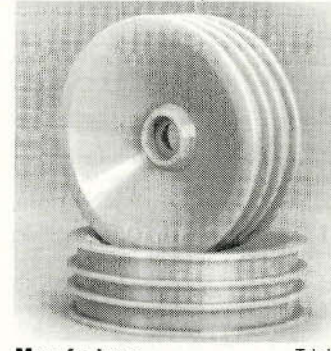
Manufacturer Trinity
Name Kyosho rims
Part no. 7600
Diameter 2.04 inches (51.86mm)
Width83 inches (21.18mm)
Bead Width23 inch (5.87mm)
Weight44 ounce
Fits Ultima fronts
Price \$6



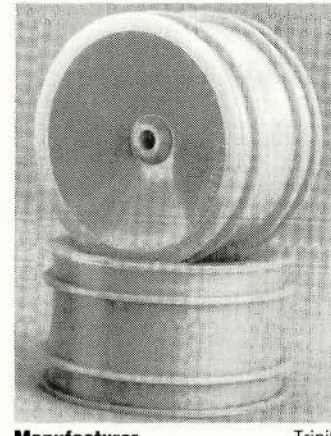
Manufacturer Trinity
Name Kyosho wheels
Part no. 7601
Diameter 2.05 inches (52.1mm)
Width 1.41 inches (35.84mm)
Bead Width27 inch (6.82mm)
Weight63 ounce
Fits Kyosho rears
Price \$6



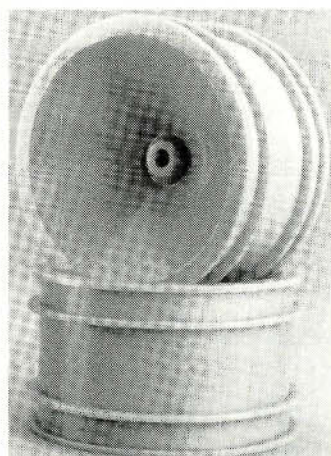
Manufacturer Trinity
Name 2.2 Kyosho rears
Part no. 7428
Diameter 2.23 inches (56.65mm)
Width 1.06 inches (27mm)
Bead Width23 inch (5.93mm)
Weight56 ounce
Fits Kyosho 4WD front
Price \$6.99



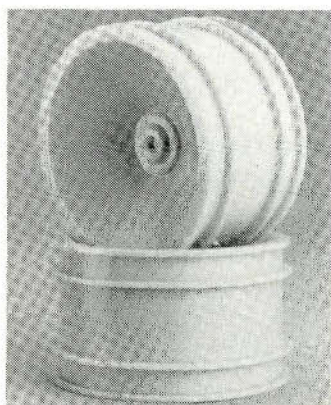
Manufacturer Trinity
Name 2.2 front
Part no. 7431
Diameter 2.18 inches (55.43mm)
Width78 inch (19.79mm)
Bead Width2 inch (5mm)
Weight49 ounce
Fits RC10, JR-X2, and Kyosho
Price \$6.99



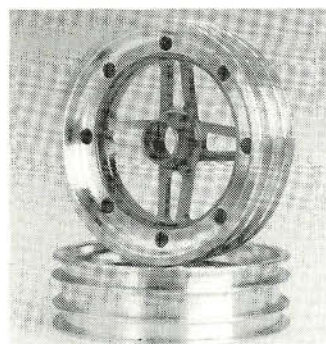
Manufacturer Trinity
Name 2.2 wheels
Part no. 7419
Diameter 2.22 inches (56.49mm)
Width 1.34 inches (34.26mm)
Bead Width24 inch (5.98mm)
Weight71 ounce
Fits JR-X2 rears
Price \$6.99



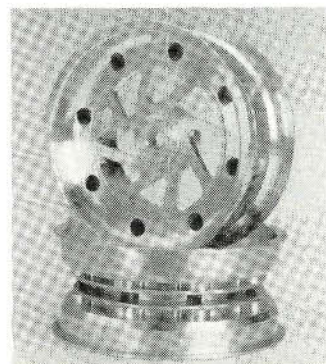
Manufacturer Trinity
Name 2.2 rear rims
Part no. 7415
Diameter 2.23 inches (56.71mm)
Width 1.38 inches (35.05mm)
Bead Width23 inch (6.07mm)
Weight74 ounce
Fits RC10 rears
Price \$6.99



Manufacturer Trinity
Name 2.2 rear
Part no. 7417
Diameter 2.23 inches (56.77mm)
Width 1.39 inches (35.45mm)
Bead Width24 inches (6.05mm)
Weight66 ounce
Fits Kyosho rears
Price \$6.99

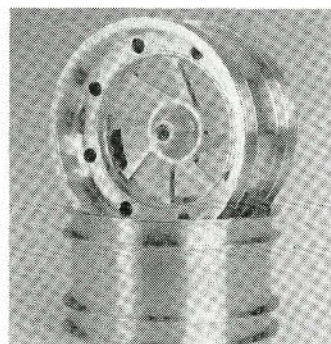


Manufacturer TecnaCraft
Name Front split spoke (gold)
Part no. 16-04-AA-G
Diameter 2.16 inches (54.95mm)
Width61 inch (15.60mm)
Bead Width16 inch (3.98mm)
Weight 1.10 ounces
Name Rear eight-spoke (gold)
Part no. 16-04-CC-G
Diameter 2.16 inches (54.93mm)
Width 1.22 inches (30.92mm)
Bead Width24 inch (6mm)
Weight 1.21 ounces
Fits JR-X2
Price \$99.95 (set)

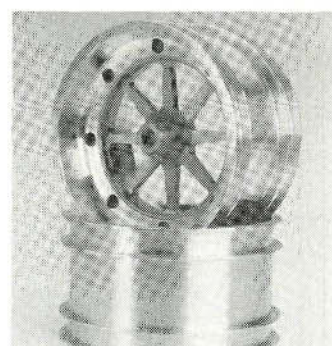
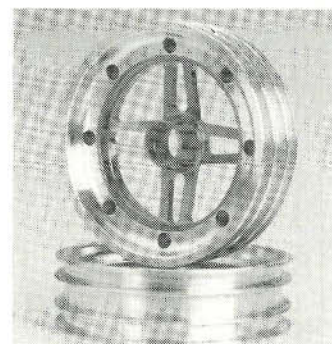


Manufacturer TecnaCraft
Name Front tangential spoke
Part no. 13-12-BB
Diameter 2.16 inches (54.94mm)
Width61 inch (15.61mm)

Bead Width16 inch (3.96mm)
Weight 1.08 ounces
Name Rear tangential spoke
Part no. 11-04-BB
Diameter 1.98 inches (50.16mm)
Width83 inch (21.17mm)
Bead Width83 inch (21.17mm)
Weight92 ounce
Fits Kyosho
Price \$99.95 (set)



Manufacturer TecnaCraft
Name Front tangential spoke
Part no. 10-12-BB
Diameter 2.16 inches (54.94mm)
Width61 inch (15.61mm)
Bead Width16 inch (3.96mm)
Weight 1.03 ounces
Name Rear tangential spoke
Part no. 10-12-BB
Diameter 2.16 inches (54.93mm)
Width 1.22 inches (30.92mm)
Bead Width24 inch (6mm)
Weight 1.17 ounces
Fits RC10
Price \$99.95 (set)



Manufacturer TecnaCraft
Name Front split four-spoke (gold)
Part no. 10-12-AA-G
Diameter 2.16 inches (54.95mm)
Width61 inch (15.60mm)
Bead Width16 inch (3.98mm)
Weight 1.10 ounces
Name Rear tangential spoke (gold)
Part no. 10-12-BB-G
Diameter 2.16 inches (54.93mm)
Width 1.22 inches (30.92mm)
Bead Width24 inch (6mm)
Weight 1.18 ounces
Fits RC10
Price \$99.95 (set)

MADCAP CONVERSION

(Continued from page 123)

IT'S OVER?

Yes, it's over—that's all there is to the conversion. The cost of all the parts, including the bearings, was about \$100. If someone makes a kit (with Lunch Box axles, if they fit), it will probably be less expensive, but this isn't a bad price for a home conversion. The only thing I haven't tried is running the MadCab against my JR-XT. With the JR-XT's race-bred chassis and suspension, I won't expect miracles, but this test will give me improvement ideas.

One of the nice things about the MadCab is that I can quickly convert it back to the Madcap just by removing the front and rear body posts and reinstalling the stock wheels and tires! And you? You just aim for the other end of the track and pull the trigger. You'll be surprised at how fast you'll get there.

**Here are the addresses of the companies mentioned in this article:*

MRC/Tamiya, 200 Carter Dr., P.O. Box 267, Edison, NJ 08818.

Pro-Line U.S.A., P.O. Box 456, Beaumont, CA 92223.

Bolink R/C Cars, Inc., 420 Hosea Rd. Lawrenceville, GA 30245.

CRP, Inc., P.O. Box 2530, Atascadero, CA 93423.

Kyosho, distributed by Great Planes Model Dist., P.O. Box 4021, Champaign, IL 61820.

Trinity Products, 1901 E. Linden Ave., Linden, NJ 07036.

Imex Model Co., 53 Trade Zone Ct., Ronkonkoma, NY 11779.

Hobby Lobby International, 5614 Franklin Pike Cr., P.O. Box 285, Brentwood, TN 37027.

Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084.

Robinson Racing Products, 165 N. Malena Dr., Orange, CA 92669. ■

HOUGE RC10

(Continued from page 86)

end than the stock RC10. Of course, this is also responsible for the disastrous nose overs, but there's no free ride, guys!

The Houge car's rear traction is also better. Although the new Championship Edition car is markedly better than the original RC10, there's still a little tail-kick when you exit a turn. The Houge rear trailing arms don't kick out. Instead, when the traction is broken, the entire car drifts sideways into a full four-wheel drift. Although you can stay on the power while drifting, you may find that the track's retaining wall is what gets you going forward, not your power slide.

ward, not your power slide.

This judgment was a close call. I don't like cars to push through turns, but I don't like drifting either. Both cars were controllable, far better than the older RC10s, but if I had to choose between the drift or a tail spin, I'd take the drift, just to stay on the power.

TRACK TIMES

Here's where the judgment ends. The clock is the final determining factor! Using the driving talents of Team Kamikaze Drivers, Mike Skube, Gregg Rhoads and Mike "the Kamikaze" Lee, both cars were track tested for the best lap times.

Although both cars are outstanding dirt vehicles, the Houge Conversion RC10 was faster—not by much, but you can't argue with the stopwatch! All three drivers reported that an edge in cornering made the car faster in laps. Both cars had virtually equal speed in a straight line (no doubt a tribute to the consistency of the Precision Motor Works powerplants), and they had very good rear traction and took the jumps well, although the Houge chassis had a flatter flight angle. The average lap times reflected a 1-second difference in favor of the Houge conversion car.

(Continued on page 144)

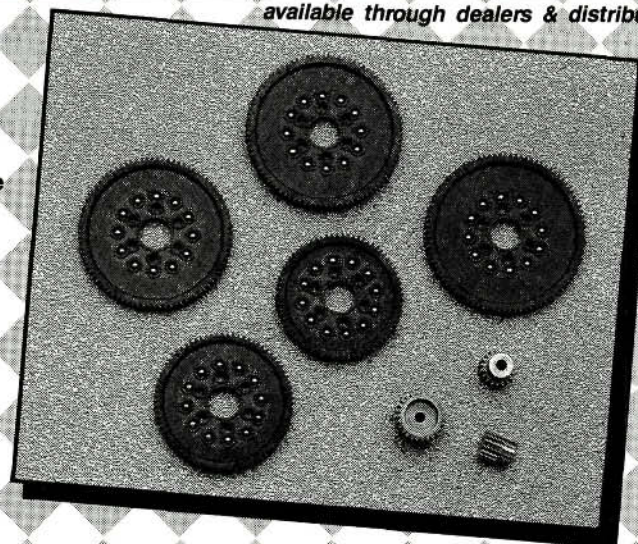
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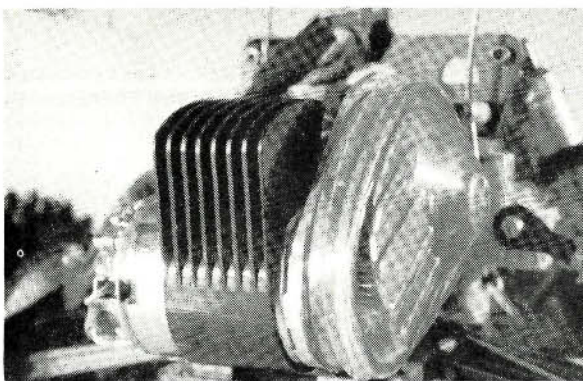
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HOUGE RC10

(Continued from page 142)

WIN—WIN!

Make no mistake, this was a tough test! The Championship Edition RC10 is a killer, but, if you already own an RC10, the way to make it really deadly is with the Houge chassis and trailing-arm kit!

*Here are the addresses of the companies mentioned in this article:

Associated Electronics, Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626.

Houge Enterprises, distributed by CompositeCraft, 5885 Lake Hurst Dr., Orlando, FL 32819.

Andy's R/C Products, 466 W. Arrow Hwy., Unit K, San Dimas, CA 91773.

Team Losi, 1655 E. Mission Blvd., Pomona, CA 91766.

Tekin Electronics, 970 Calle, Negocio, San Clemente, CA 92672.

Precision Motor Works, 4950 Waring Rd., Suite #12, San Diego, CA 92120.

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.

Kimrough Products, 1430 East St. Andrews Place, Unit F, Santa Ana, CA 92705.

Sanyo Electric, Battery Div., 200 Riser Rd., Little Ferry, NJ 07643.

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Shock Waves

OFF-ROAD CARS can go over mounds of dirt and fly through the air—you get the idea. To survive the abuse they're usually subjected to, the cars must have some protection, and that's where suspension comes in. It provides a way for a car to absorb the impact of landing after high jumps, and it helps it to cope with bumps in the track. Springs can't do the job alone, so shock absorbers were designed to help cars stay in one piece.

Shock absorbers help a car's suspension by reducing the effect of bumps. This damping action can be adjusted a variety of ways, of which the most common is changing the shock oil that's inside the shock absorber. The thicker the oil, i.e., the higher its viscosity, the more slowly the shock will respond to an impact, and the more the chassis will have to absorb some of the shock of bumps and landings. If a thinner (lighter weight) oil is used, the suspension will be too responsive, and the car will be so springy that it bounces all over the place and often bottoms-out.

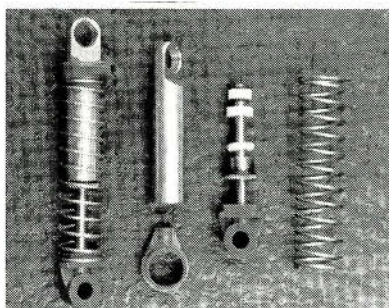
Set up the shocks so that they're firm enough to make the chassis just barely bottom-out after the highest jumps, but soft enough to react quickly to small undulations in the track. You can adjust the shocks' damping characteristics by varying the oil and changing the shock piston. The lighter the shock oil (not pounds, but viscosity or thickness), the softer the suspension. The more holes there are in the piston, the softer the suspension will be. Changing to a heavier oil or a piston with fewer holes will stiffen the suspension. When your suspension works correctly, your car doesn't bottom-out over the rough stuff, and it rides over small bumps without pitching from side to side.

Spring tension is the most misunderstood "tuning tool," and it mostly affects your vehicle's ride height. Increase the tension, and your car will ride high; decrease it, and it will be lower at speed. Before attempting to adjust your spring tension, drop your car from 10 to 12 inches above your work surface to see how high it bounces on landing. It should spring up enough for the suspension arms to be level with the chassis. Spring tension doesn't affect the car's damping.

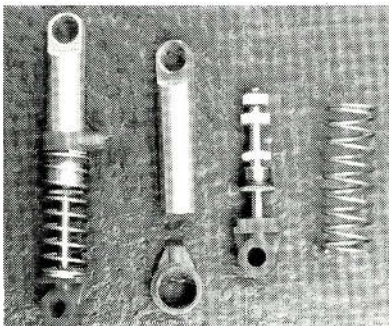
There are many more ways in which you can adjust your car's suspension: you can vary the damper angle, use Variflo devices, transfer weight and change the chassis loading. In the following pages, we list the shocks available and their major features (prices, part numbers and distance of travel) so you can see which will fit your car or truck. Good luck!—and don't let anything dampen your spirits!

by RCCA STAFF

CRP

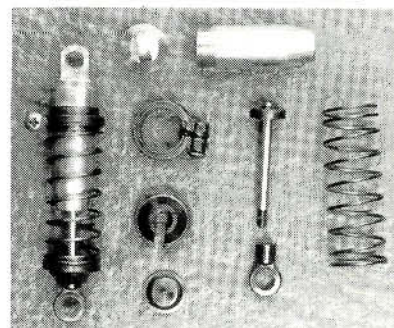


Name Replacement Shocks, FX-10
Part no. 1558
Material Aluminum
Springs One set included
Extended length 2.65 ins. (66.16mm)
Compressed length 2 ins. (51.68mm)
Mounting length 2.39 ins. (59.05mm)
Shaft diameter12 in. (3mm)
Bore22 in. (5.59mm)
Stroke65 in. (16.51mm)
Features Pre-built
Price \$16.99

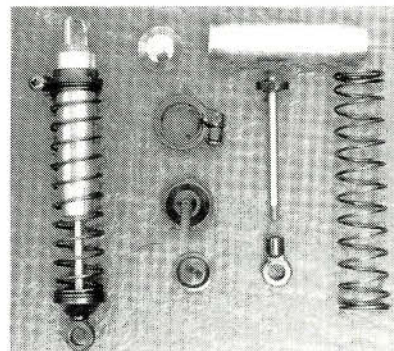


Name Replacement Shocks
Part no. 1631
Material Aluminum
Springs One set included
Extended length 2.62 ins. (66.17mm)
Compressed length 2 ins. (51.65mm)
Mounting length 2.37 ins. (59.04mm)
Shaft diameter12 in. (3mm)
Bore22 in. (5.59mm)
Stroke62 in. (15.74mm)
Features Pre-built
Price \$16.99

DURATRAX

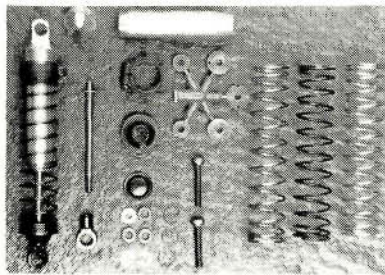


Name Competition Shocks (front)
Part no. DTXC 3500
Material Aluminum
Springs One set included
Extended length 2.93 ins. (73.81mm)
Compressed length 2.39 ins. (59.97mm)
Mounting length 2.55 ins. (64.68mm)
Shaft diameter12 inch (3mm)
Bore39 in. (9.9mm)
Stroke54 in. (13.72mm)
Features Pre-assembled
Price \$24.95

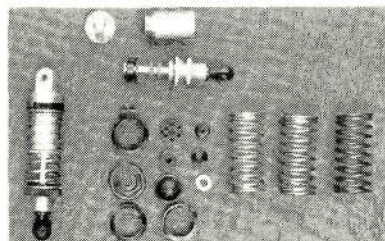


Manufacturer Duratrax
Name Competition Shocks (rear)
Part no. DTXC 3501
Material Aluminum
Springs One set included
Extended length 3.95 ins. (100.04mm)
Compressed length 3.05 ins. (76.25mm)
Mounting length 3.62 ins. (91.75mm)
Shaft diameter12 in. (3mm)
Bore39 in. (9.9mm)
Stroke90 in. (22.86mm)
Features Pre-assembled
Price \$24.95

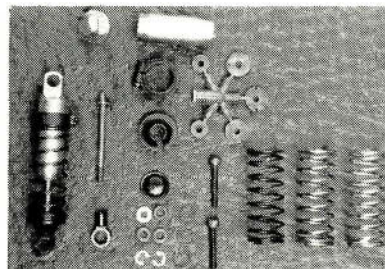
KYOSHO



Name Platinum Oil Shocks (long)
Part no. W-5004
Material Aluminum
Springs Three sets included
Extended length 3.92 ins. (99.57mm)
Compressed length 3 ins. (76.2mm)
Mounting length 3.60 ins. (91.44mm)
Shaft diameter155 in. (3.95mm)
Bore43 in. (10.92mm)
Stroke92 in. (23.37mm)
Features Adjustable by means of ball end
Price \$39.95

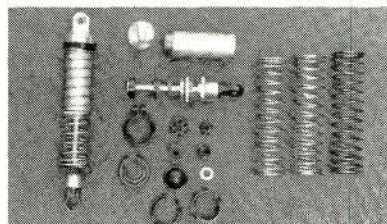


Name Platinum Oil Shocks (short)
Part no. W-5003
Material Aluminum
Springs Three sets included
Extended length 3.06 ins. (77.59mm)
Compressed length 2.53 ins. (64.26mm)
Mounting length 2.64 ins. (67.1mm)
Shaft diameter155 in. (3.95mm)
Bore43 in. (10.92mm)
Stroke53 in. (13.47mm)
Features Adjustable damping by means of ball end
Price \$39.95

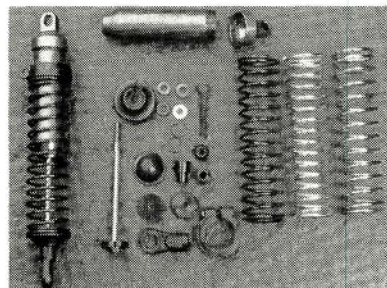


Name Gold (Short)
Part no. W-5001
Material Aluminum
Springs Three sets included
Extended length 2.96 ins. (75.61mm)
Compressed length 2.28 ins. (58.26mm)
Mounting length 2.61 ins. (68.27mm)
Shaft diameter12 in. (3mm)
Bore32 in. (8.13mm)

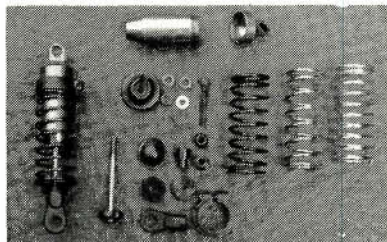
Stroke68 in. (17.28mm)
Price \$34.95



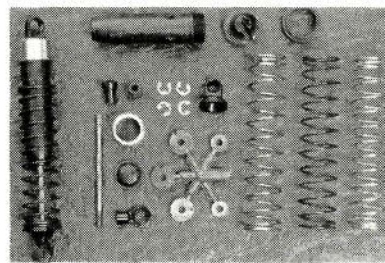
Name Gold (Long)
Part no. W-5002
Material Aluminum
Springs Three sets included
Extended length 4 ins. (101.37mm)
Compressed length 2.98 ins. (75.92mm)
Mounting length 3.61 ins. (92.19mm)
Shaft diameter12 in. (3mm)
Bore32 in. (8.13mm)
Stroke 1.02 ins. (25.91mm)
Price \$34.95



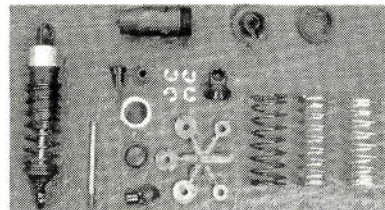
Name Big Pressure Oil Shock (rear)
Part no. BSW-28
Material Aluminum
Springs Three sets included
Extended length 4.74 ins. (120.38mm)
Compressed length 3.39 ins. (86mm)
Mounting length 4.35 ins. (110.59mm)
Shaft diameter12 in. (3mm)
Bore47 in. (11.94mm)
Stroke 1.35 ins. (34.3mm)
Features Extra large
Price \$43.95



Name Big Pressure Oil Shock (small)
Part no. BSW-27
Material Aluminum
Springs Three sets included
Extended length 3.49 ins. (88.84mm)
Compressed length 2.80 ins. (71.16mm)
Mounting length 3.17 ins. (80.54mm)
Shaft diameter12 in. (3mm)
Bore47 in. (11.94mm)
Stroke69 in. (17.74mm)
Features Extra large
Price \$43.95

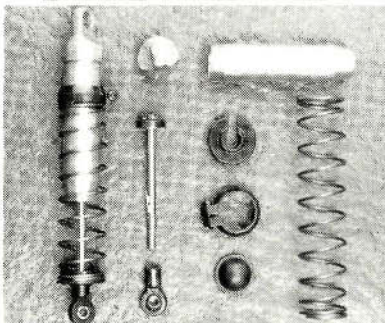


Name Black Dampener (L)
Part no. FD-38
Material Kelron Composite
Springs Three sets included
Extended length 3.98 ins. (101.14mm)
Compressed length 3.02 ins. (76.6mm)
Mounting length 3.65 ins. (92.6mm)
Shaft diameter12 in. (3mm)
Bore39 in. (10.02mm)
Stroke96 in. (24.4mm)
Features Lightweight
Price \$16



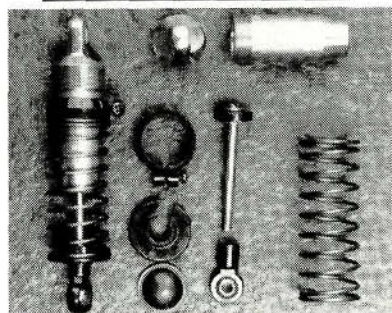
Name Black Dampeners (S)
Part no. FD-37
Material Kelron composite
Springs Three sets included
Extended length 3.08 ins. (78.3mm)
Compressed length 2.39 ins. (60.71mm)
Mounting length 2.75 ins. (69.85mm)
Shaft diameter12 in. (3mm)
Bore39 in. (10.02mm)
Stroke69 in. (17.53mm)
Features Lightweight
Price \$16

PARMA



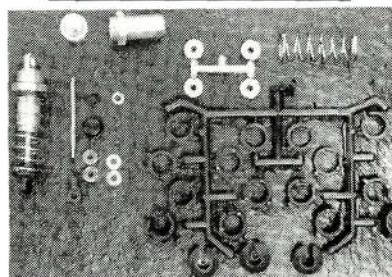
Name Shock Absorber Set (long)
Part no. 12609
Material Aluminum
Springs One set included
Extended length 3.95 ins. (100.05mm)
Compressed length 3.05 ins. (76.33mm)
Mounting length 3.63 ins. (92.56mm)
Shaft diameter12 in. (3mm)
Bore40 in. (10.16mm)
Stroke90 in. (22.86mm)
Features Pre-assembled and oil-filled
Price \$30

PARMA

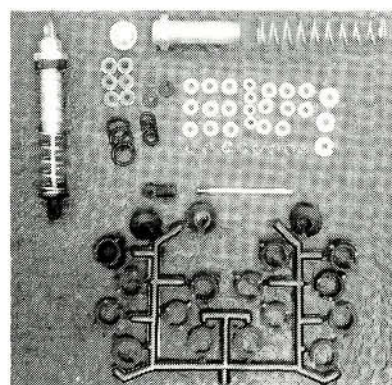


Name Oil-Filled Front Shocks
Part no. 12607
Material Aluminum
Springs Soft included
Extended length 2.96 ins. (75.41mm)
Compressed length 2.24 ins. (59.17mm)
Mounting length 2.69 ins. (66.74mm)
Shaft diameter12 in. (3mm)
Bore40 in. (10.16mm)
Stroke72 in. (18.28mm)
Features Pre-filled with oil
Price \$25

SCHUMACHER



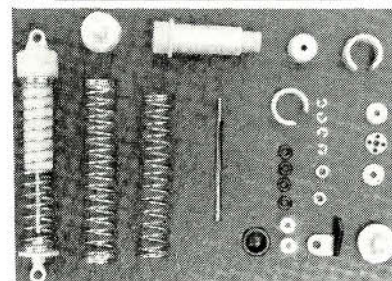
Name Front Shock Absorbers
Part no. T633
Material Aluminum
Springs One set included
Extended length 3.12 ins. (79.41mm)
Compressed length 2.40 ins. (61.22mm)
Mounting length 2.82 ins. (71.85mm)
Shaft diameter12 in. (3mm)
Bore40 in. (10.23mm)
Stroke72 in. (18.28mm)
Price \$40



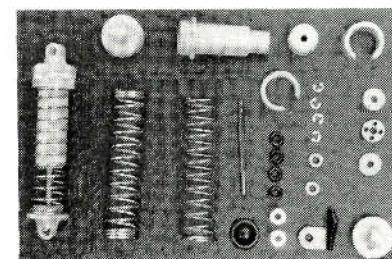
Name Long Rear
Part no. T634
Material Aluminum
Springs Medium included
Extended length 3.90 ins. (98.98mm)

Compressed length 2.77 ins. (70.46mm)
Mounting length 3.58 ins. (91.03mm)
Shaft diameter12 in. (3mm)
Bore40 in. (10.23mm)
Stroke 1.13 ins. (28.7mm)
Price \$50

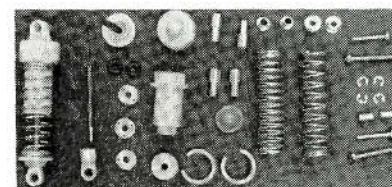
TAMIYA



Name C.V.A. Long
Part no. 50304
Material Nylon
Springs Soft and hard included
Extended length 4.51 ins. (114.64mm)
Compressed length 3.38 ins. (85.88mm)
Mounting length 4.25 ins. (108mm)
Shaft diameter12 in. (2.95mm)
Bore39 in. (9.94mm)
Stroke 1.13 ins. (28.7mm)
Price \$21.45

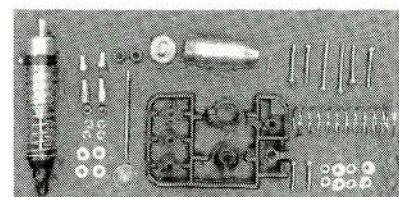


Name C.V.A. Short
Part no. 50305
Material Nylon
Springs Soft and hard included
Extended length 3.32 ins. (84.31mm)
Compressed length 2.67 ins. (67.9mm)
Mounting length 3.05 ins. (77.5mm)
Shaft diameter12 in. (2.95mm)
Bore39 in. (9.94mm)
Stroke65 in. (16.5mm)
Price \$21.45

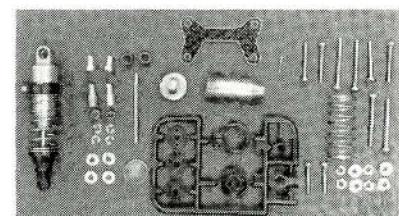


Name C.V.A. Mini
Part no. 50332
Material Nylon
Springs Soft and firm
Extended length 2.83 ins. (71.89mm)
Compressed length 2.18 ins. (55.25mm)
Mounting length 2.56 ins. (65.04mm)
Shaft diameter12 in. (2.95mm)
Bore35 in. (9.07mm)

Stroke65 in. (16.51mm)
Price \$15.35

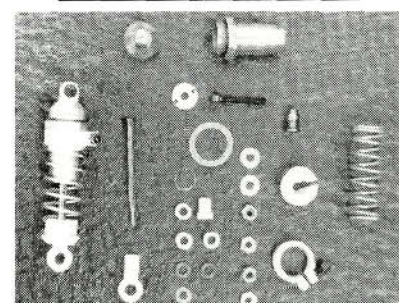


Name Hi-Cap Dampers (rear)
Part no. 53037
Material Aluminum
Springs Medium included
Extended length 3.85 ins. (97.72mm)
Compressed length 2.72 ins. (69.21mm)
Mounting length 3.56 ins. (90.5mm)
Shaft diameter12 in. (2.95mm)
Bore47 in. (11.96mm)
Stroke 1.13 ins. (28.7mm)
Price \$31.50

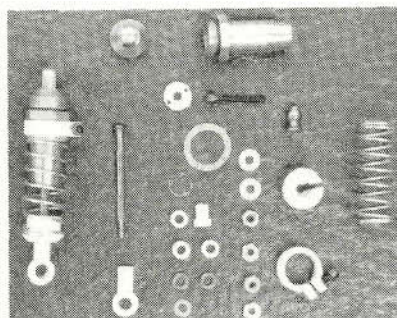


Name Hi-Cap Dampers (front)
Part no. 53036
Material Aluminum
Springs Medium included
Extended length 3.08 ins. (78.24mm)
Compressed length 2.41 ins. (61.31mm)
Mounting length 2.75 ins. (69.84mm)
Shaft diameter12 in. (2.95mm)
Bore47 in. (11.96mm)
Stroke67 in. (17.05mm)
Price \$30

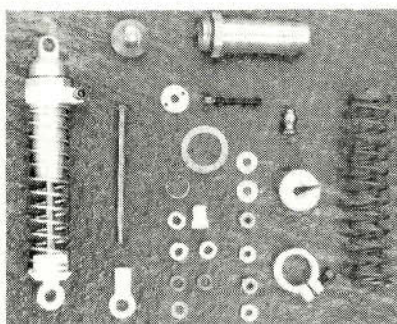
TEAM ASSOCIATED



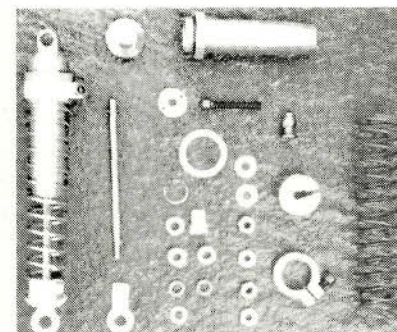
Name Front Shock (Short Stroke)
Part no. 6449
Material Aluminum
Springs None included
Extended length 2.80 ins. (71.28mm)
Compressed length 2.26 ins. (57.31mm)
Mounting length 2.45 ins. (62.35mm)
Shaft diameter12 in. (3.09mm)
Bore40 in. (10.27mm)
Stroke54 in. (13.72mm)
Price \$25



Name Front Shock (Long Stroke)
Part no. 6448
Material Aluminum
Springs None included
Extended length 3.10 ins. (78.81mm)
Compressed length 2.41 ins. (61.16mm)
Mounting length 2.76 ins. (70.91mm)
Shaft diameter12 in. (3.09mm)
Bore40 in. (10.27mm)
Stroke69 in. (17.52mm)
Price \$25



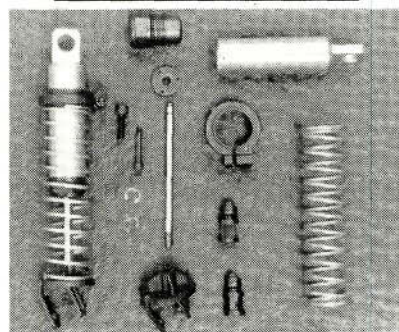
Name Rear Shock (Short Stroke)
Part no. 6447
Material Aluminum
Springs None included
Extended length 3.81 ins. (96.74mm)
Compressed length 2.75 ins. (69.97mm)
Mounting length 3.59 ins. (88.11mm)
Shaft diameter12 in. (3.09mm)
Bore40 in. (10.27mm)
Stroke 1.06 ins. (26.92mm)
Price \$25



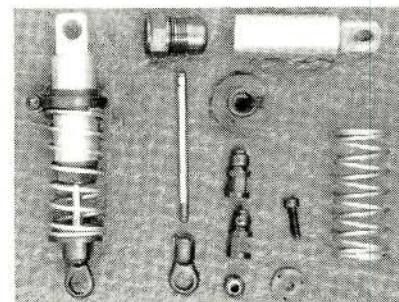
Name Rear Shocks (Long Stroke)
Part no. 6446
Material Aluminum
Springs None included
Extended length 4.40 ins. (111.87mm)
Compressed length 3.04 ins. (77.42mm)
Mounting length 4.07 ins. (103.39mm)
Shaft diameter12 in. (3.07mm)
Bore40 in. (10.27mm)

Stroke 1.36 ins. (34.63mm)
Price \$25

TEAM LOSI

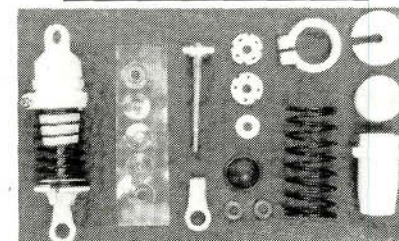


Name Rear Shocks
Part no. A-5001
Material Aluminum
Springs Medium included
Extended length 4 ins. (102.32mm)
Compressed length 3.16 ins. (80.16mm)
Mounting length 3.63 ins. (91.28mm)
Shaft diameter125 ins. (3.16mm)
Bore40 in. (10.35mm)
Stroke92 in. (22.89mm)
Price \$25



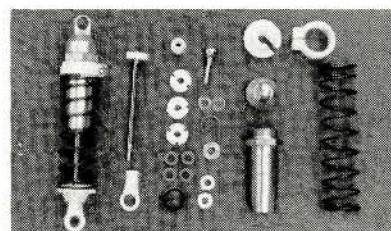
Name Front Shocks
Part no. A-5000
Material Aluminum
Springs Medium included
Extended length 3.26 ins. (83.34mm)
Compressed length 2.74 ins. (69.97mm)
Mounting length 2.98 ins. (74.41mm)
Shaft diameter125 in. (3.16mm)
Bore40 in. (10.35mm)
Stroke52 in. (13.21mm)
Price \$25

TRAXXAS

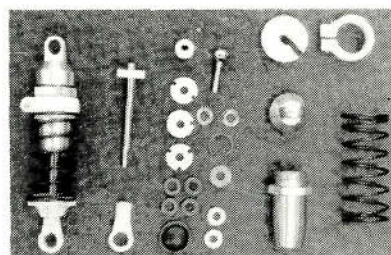


Name Oil Dampeners Plastic Front
Part no. 1761
Material Plastic
Springs Medium included
Extended length 2.83 ins. (72.31mm)
Compressed length 2.31 ins. (59.62mm)
Mounting length 2.46 ins. (63.21mm)

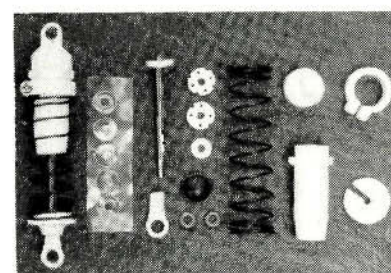
Shaft diameter12 in. (3mm)
Bore42 in. (10.67mm)
Stroke51 in. (12.78mm)
Price \$16



Name TRX-10 Rear Oil Shocks
Part no. 1610
Material Aluminum
Springs Heavy included
Extended length 3.61 ins. (92.07mm)
Compressed length 2.68 ins. (67.31mm)
Mounting length 3.32 ins. (84.19mm)
Shaft diameter12 in. (3mm)
Bore38 in. (9.58mm)
Stroke93 in. (23.63mm)
Price \$25



Name TRX-10 Front Oil Shocks
Part no. 1661
Material Aluminum
Springs Medium included
Extended length 2.98 ins. (74.26mm)
Compressed length 2.31 ins. (60.92mm)
Mounting length 2.51 ins. (65.52mm)
Shaft diameter12 in. (3mm)
Bore38 in. (9.58mm)
Stroke67 in. (17.02mm)
Price \$25



Name Oil Dampeners Plastic Rear
Part no. 1760
Material Plastic
Springs Medium included
Extended length 3.61 ins. (93.02mm)
Compressed length 2.71 ins. (70.01mm)
Mounting length 3.31 ins. (84.26mm)
Shaft diameter12 in. (3mm)
Bore42 in. (10.67 mm)
Stroke90 in. (22.86mm)
Price \$16

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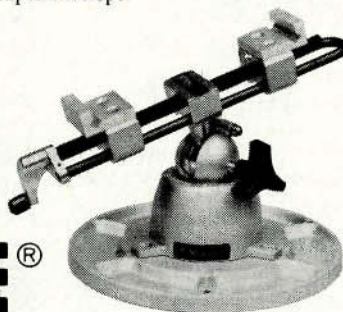
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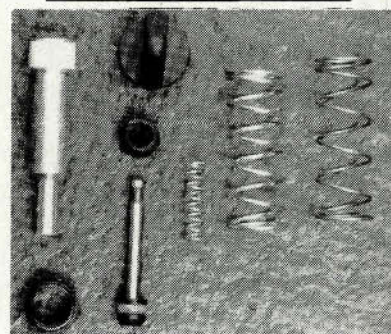
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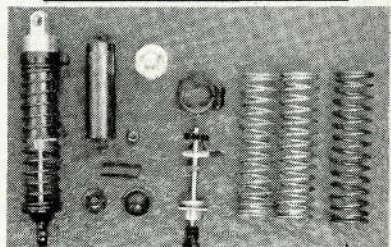
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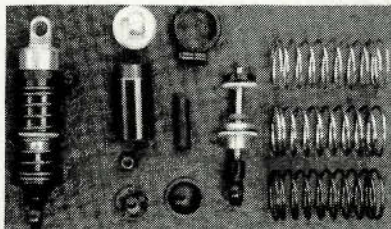


Name Pressurized
Part no. 148
Material Aluminum
Springs Two included
Extended length 2.42 ins. (61.46mm)
Compressed length ... 2.02 ins. (52.84mm)
Mounting length 2 ins. (52.21mm)
Shaft diameter125 in. (3.18mm)
Bore24 in. (6.28mm)
Stroke40 in. (10.16mm)
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Name Power Shocks (rear)
Part no. 7133
Material Aluminum
Springs Three sets included
Extended length 3.92 ins. (99.68mm)
Compressed length ... 2.89 ins. (73.44mm)
Mounting length 3.57 ins. (90.57mm)
Shaft diameter12 in. (2.95mm)
Bore43 in. (10.92mm)
Stroke 1.03 ins. (26.21mm)
Features Purple anodized
Price \$25.99



Name Power Shocks (front)
Part no. 7132
Material Aluminum
Springs Three sets included
Extended length 2.89 ins. (73.39mm)
Compressed length ... 2.26 ins. (57.33mm)
Mounting length 2.55 ins. (64.72mm)
Shaft diameter12 in. (2.95mm)
Bore43 in. (10.92mm)
Stroke63 in. (16mm)
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NORRCA NATS

(Continued from page 96)

any "home-field advantage" that might have existed was no longer of consequence.

The lower mains went off on schedule, and soon the headliners were up. With the temperature and humidity well into the 90s, things were heating up fast!

2WD STOCK

The Stock 2WD A-Main was first, and it was surprising that all the cars made it through turn 1 without a huge pile-up! Chris White made the best of his pole spot and began to stretch his lead, but Carlos Gonzales followed in hot pursuit. At the 27-second mark, Scott Roberts was the first out with systems failure. While White and Gonzales pulled away, a battle developed between David Hill and Gene Mason for 3rd. The rest of the field settled into the remainder of the race, and there was little action between the back-markers.

With about 30 seconds to go, Gonzales tried to make his move, but White hit all the right lines and held on for an exciting win. Less than 1 second separated the

(Continued on page 167)

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(Continued from page 162)

front-runners, and Hill, J.J. Trujillo and David Joor rounded out the top five.

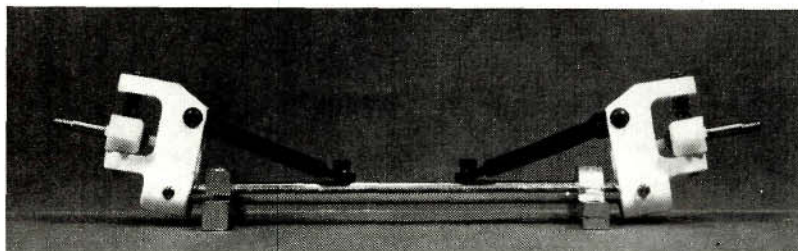
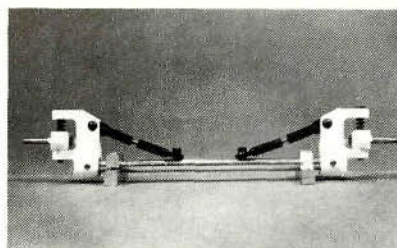
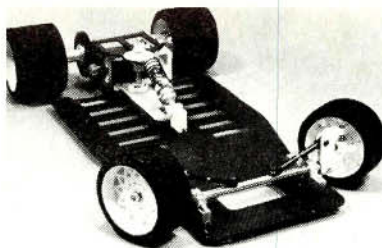
4WD OPEN

Jack Johnson demonstrated why he's one of the major forces in off-road racing with an impressive wire-to-wire win against some of the country's best drivers. He drove away from the pack as Mike Dunn, Gil Losi, Jr. and Dominic Sellers hooked up in a fight for the runner-up spot. Back in the pack, Brian Kinwald flipped in the double jumps, and this allowed Rick Vehlow and Steve Ozuna to get by. J.D. Beckwith made an unscheduled trip behind the wall and was the first out.

Johnson continued to stretch his lead: at the midway mark, he had already put Chris Allec and J.B. Hunt a lap down. Dunn was doing a good job of holding off a charging Losi, Jr. until he clipped a board; Gil slipped by and set his sight on the leader, but Johnson was too far ahead for anyone to make a serious charge. A battle for 4th was shaping up; Vehlou and Kinwald switched spots and crossed the line virtually side-by-side. Losi, Jr. and

(Continued on page 168)

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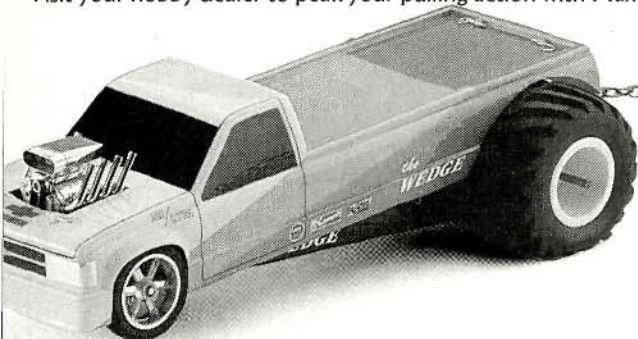
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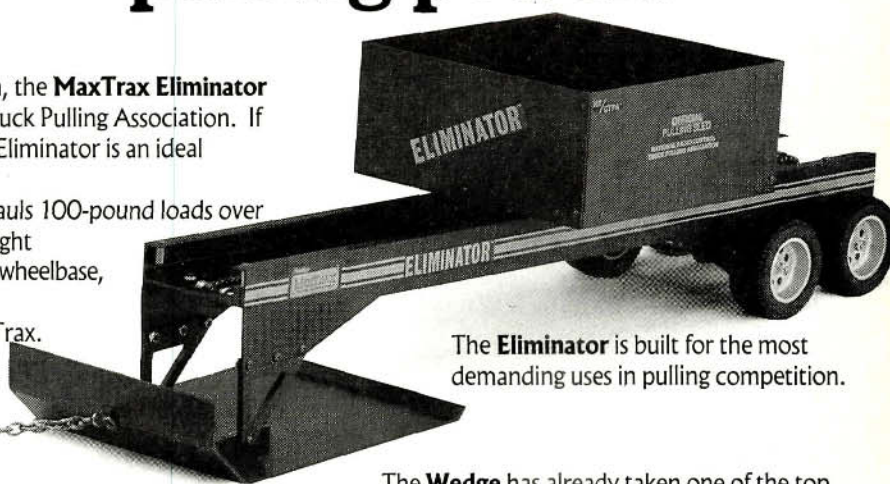
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NORRCA NATS

(Continued from page 167)

Dunn held on for 2nd and 3rd, respectively.

SUPER STOCK TRUCK

In Super Stock Truck, David Potter, Tom Owens, Bill Ogden and Scott Brown made it through a first-turn pile-up while the turn marshals sorted out the rest of the field. Potter took the early lead, and Brown moved up to 2nd, followed by Ogden and Owens. Soon, the lead pack developed a case of the nerves, though; Potter, Ogden, Mike Dunlap and Owens all collided, and this allowed Brown to open up a slight lead at mid-race.

Potter broke clear, moved into 2nd and set out after Brown. The rest of the pack started to fall off the pace, but Potter and Brown were engaged in a duel for the lead that brought the crowd to its feet! Potter closed in on Brown's "back door," and the two went bumper to bumper around the last lap. Potter made a desperate move on the final turns, but Brown held on to win his first National Championship.

(Continued on page 173)



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NORRCA NATS

(Continued from page 168)

4WD STOCK

Chris Allison got the holedshot on Carlos Gonzales and took the lead through turn 1. Brian Stricklin and Jeff Holsted settled in right behind, and it became a four-car race. Gonzales was all over Allison and finally pulled off a great inside move in turn 3 to take over the lead. Sandy Hunt was making up lost time, and by the half-way mark, he had moved into 4th.

With a clear track in front of him, Gonzales poured on the power in his ERP "zapped" motor (see sidebar) and turned this race into a joke! There was still some good racing back in the pack, however, as Stricklin, Hunt, Richard Starr and Doug Handel all tangled in front of the scoring bridge with a minute left to go. Holsted and Stricklin broke loose first and waged their own battle for 3rd. They swapped position several times, and Stricklin crossed the line a mere .003 of a second ahead of Holsted! Hunt came back to take 5th, but only Gonzales and Allison completed 11 laps.

2WD OPEN

"Mr. TQ" Jack Johnson led the 2WD Open field through turn 1, but Rick Vehlow, who made an impressive start from the 5th spot, hooked up right behind him. As the drivers jockeyed for position, Mike Dunn snuck by Vehlow as did Cameron Kellogg and Mike Tuntakit. The field started to stretch out, Johnson and Dunn pulled away from the pack, and Gil Losi, Jr. began one of his patented charges to the front.

The two leaders tangled at the halfway mark, and this allowed Dunn to pass Johnson and Losi, Jr. to come within striking distance. With Losi, Jr. right on Johnson's six, they both started to gain ground on Dunn. Johnson finally made his move and passed Dunn in turn 6, and Losi, Jr. was hung out to dry! Meanwhile, a few turns back, Tuntakit, Kellogg and Kyle Reed were putting on a show for 4th.

With less than 30 seconds left, Dunn broke down just before the scoring bridge, and Losi, Jr. stole 2nd. Time was running out! Johnson turned in the only 12-lap run of the show, and Losi, Jr. went unchallenged for the runner-up spot, followed by

Tuntakit, Kellogg and Reed. Mike Dunn's great run ended in a disappointing 6th-place finish.

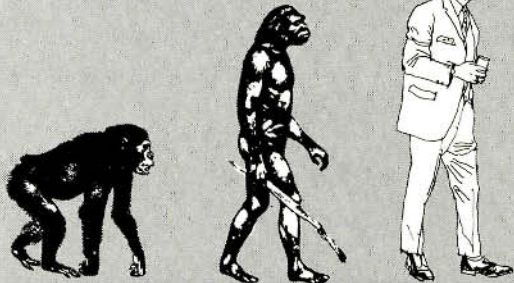
OPEN TRUCK

The last time I saw a race this exciting was a few years ago when Elliott and Earnhart went at it in the Busch Clash! The flag was dropped for the Open Truck A-Main, and the action began immediately. A major pile-up (what else!) occurred in turn 1, and the pole sitter, Jack "Hat Trick" Johnson was drop-kicked to last place. When the dust had settled, Mike Dunn, Gary Kyes and David Hill brought the field around for the first circuit.

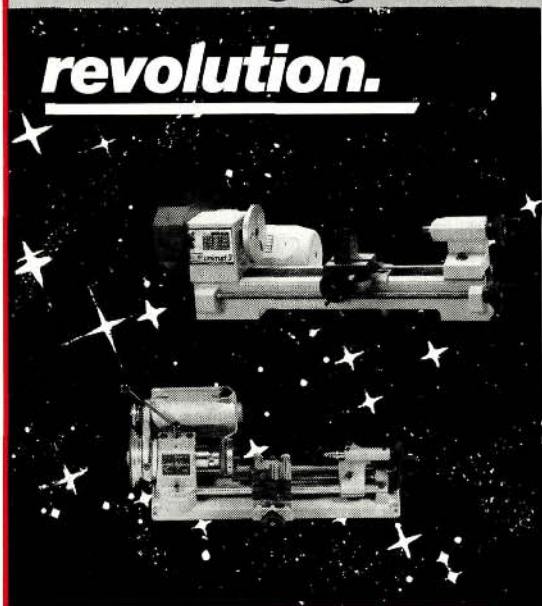
With less than a minute down, Johnson made a ballistic charge through the field to come within sight of the lead pack. While Kyes, Dunn and Kyle Reed were doing their best to lose the lead, Tom Owens stayed out of trouble and was right behind the "Harvey Wallbangers"! Dunn, Reed and Kyes collided again, and this allowed Owens to move into 2nd. Johnson was now in the thick of it, too, and the five leaders had the crowd on their feet and roaring with approval.

(Continued on page 176)

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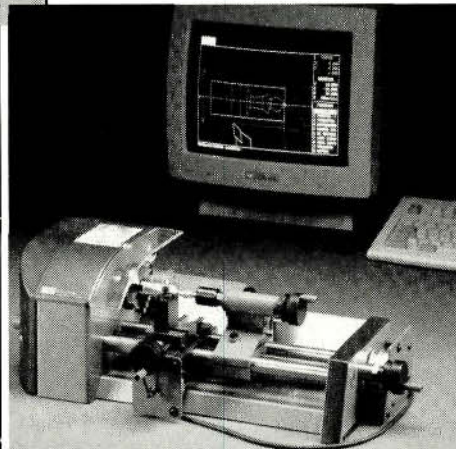
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NORRCA NATS

(Continued from page 173)

Basic physics says that you can only fit so much mass into a given space, but these guys forgot that principle! Kyes took the lead but rolled it in turn 5, and the lead pack went over, under, through and around him! Reed came out on top, but Owens, Johnson and Dunn were right behind. Brother Dunn (Steve) was off the pace, but made his presence known as he crashed into the first-turn wall at nearly the speed of sound! His day was done.

With less than a minute to go, Johnson got by Owens and went after teammate Reed. Meanwhile, the "forgotten guys"—Scott Montgomery, Steve Ozuna and Hill—were waging their own wild fight right behind the lead pack. While Johnson and Reed continued to beat on each other (no team order here, right "Pops"?!) and eventually locked horns, Owens slid by on the outside and took over the top spot.

As the cars passed the scoring tower, the horn sounded for the final lap. Owens led the pack down the front straight, but he cut it too close in turn 1 and rolled it! Johnson and Reed got by, but they also tangled (for the umpteenth time!) and this allowed Owens to recapture the lead. (You get the idea?!) Reed got going again as Montgomery snuck by Johnson, and it was now a run-away freight train to the finish.

Reed tried to drive around Owens at every turn and made one desperate effort on the final one, but Owens held his line this time and won his first National Championship, for himself and Team Traxxas. Because of incredible crowd noise, the drivers went at it for nearly an entire lap before they realized the race was over! I can't imagine how that lap would have turned out!

This was definitely one of the most exciting, well-run, and well-organized National events that I've ever attended. The NORRCA officials (especially J. R. Sitman) and the owners of the host track, Norm and Karen Mazzola, should be congratulated. Thanks to all the volunteers and the spectators for their support and enthusiasm! ■

ROAR NATS

(Continued from page 106)

by ROAR Administrator John Thawley. He also received 1st-place trophies and a dip in the hotel pool!

We saw some of the best racing ever at Hobby Haven track—a first-class facility. The race results prove a few things: the latest RC10s are good; 4WD class is hot again; and the newest rising star is the Laser, even though it didn't win the A-Main. The torque-limiting speed controllers are the cat's meow; Losi X-pattern tires are "in"; and indoor racing facilities will be common in the future.

R/C Car Action salutes Cliff Lett in his double victory and Hobby Haven Raceway for their track. Boy, wait till '91! ■

TRACK DIRECTORY

In keeping with our constant efforts to help foster the growth of the radio-control car hobby, we print this track directory intermittently to inform modelers where they can race and exchange ideas. If you'd like your track listed, send the track's name, address and phone number to R/C Car Action Track Directory, 251 Danbury Road, Wilton, CT 06897. We'll list as many clubs as space allows.

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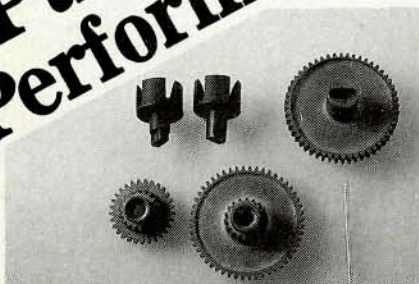
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(Continued on page 190)

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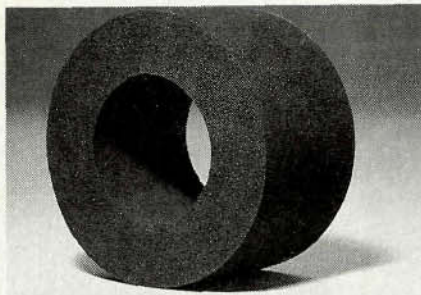
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(Continued on page 195)

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(Continued from page 190)

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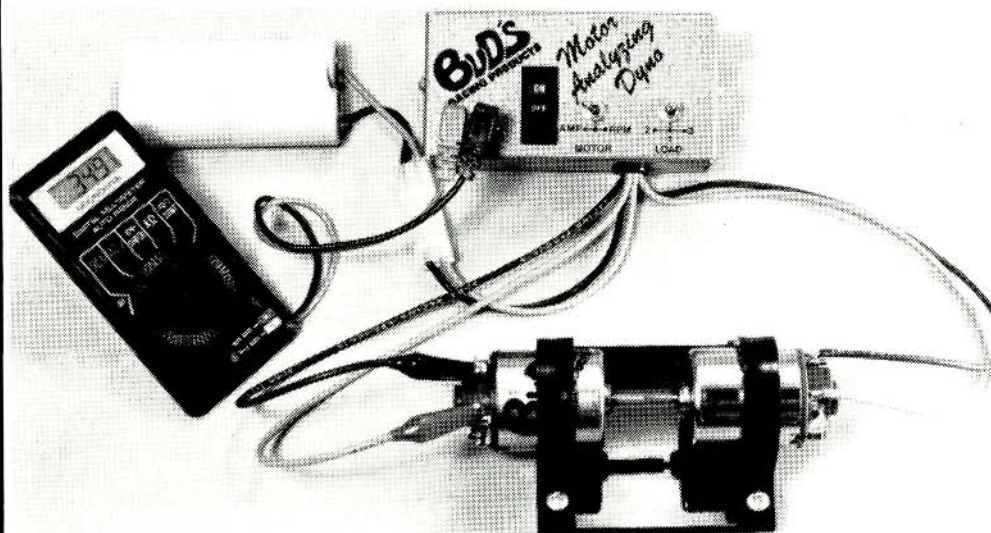
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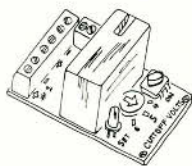
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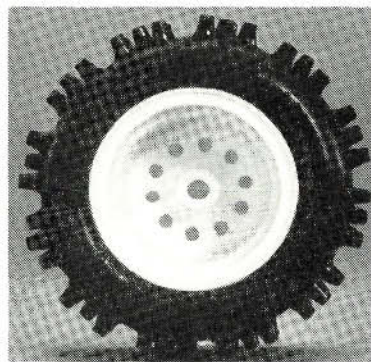
WHAT'S NEW



PRO-LINE Cone Dish Racing Wheels

Pro-Line's new Cone Dish Racing Wheels can be used on a variety of tracks—from off-road to clay oval to pavement. Use the no. 2558 and the new no. 2566 as off-road stock replacements for the RC10. To create an RC10 Sprint or on-road car, try the no. 2557 and no. 2558 with Striker IIs (no. 1051) on the rear and the Striker IIIs (no. 1053) on the front. You can use the same combination on the JR-X2 and Kyosho.

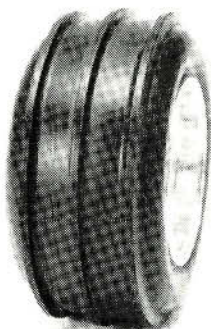
Price: \$4.95/pair



Direct-Fit JR-X2 and JR-XT Monster-Truck Wheel

Performance, style and durability are combined in one wheel! Pro-Line U.S.A. has developed the "Deep Dish 10-Hole" direct-fit wheels for the JR-X2 Monster Truck Conversions and the JR-XT. Designed to be very realistic, they contain a high-grade, lightweight, nylon that's resilient and fracture-resistant even under racing conditions.

Price: \$7.95/pair



New Front Runner

Pro-Line's new Front Runner has already received recognition as an excellent racing-truck front tire. During the Monster Truck Nationals and the Cactus Classic, it impressed racers with its consistently high performance on a variety of tracks.

The Front Runner has three winning features: the three-rib track tread, which allows low resistance in straightaways and excellent tracking in sweeps (this design will be effective in truck-pulling competition, too); the webbing inside the tire, which improves stability and handling on multiple-turn tracks; and the soft-compound construction.

Price: \$10.95/pair

Part no. 1054 (2.2-inch wheel)

For more information, contact Pro-Line, P.O. Box 456, Beaumont, CA 92223.



DURATRAX 1500mAh Plus Batteries

DuraTrax announces a new 1500mAh battery that's available in 6- and 7-cell packs and in flat or hump styles. DuraTrax 1500mAh cells are also available with Tamiya and Kyosho connectors.

Price: \$24.95

For more information, contact Great Planes Model Distributors Co., 1608 Interstate Dr., Champaign, IL 61820.



PARMA Pro-Stock Drag Body

Quarter-mile fans—check this out! Parma has a hot, new, 1/10-scale, pro-stock drag body—the Ford Probe. It's shown here with a wing made from the Parma Wings 'n Things kit (not included).

Part no. 10302, \$19; no. 10415 (.030x9x9 1/4 clear Lexan sheet), \$3.



Sport Truck

Parma's 1/10-scale California Sport Truck body is now available separately! Identical to the kit's body, it comes in crystal-clear Lexan, complete with ground-effects styling and graphics decal.

Price: \$23.50

Part no. 10318



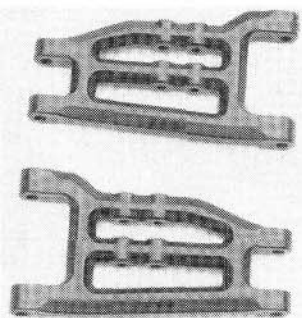
Clod Buster 2000mAh Pack

Spend less time charging and more time having fun! Try Parma's 2000mAh C-size Sanyo saddle pack for the Tamiya Clod Buster. This powerful pack comes completely assembled.

Price: \$55

Part no. 11224

For more information, contact Parma International, 13927 Progress Pkwy., North Royalton, OH 44133.

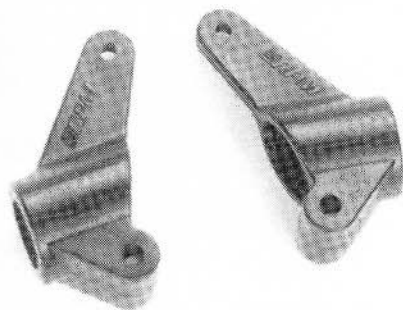


RPM JR-XT Wide Front Arms

RPM now makes extra-wide front arms for the JR-XT and JR-X2 truck conversions. They're 1/4 inch wider than stock arms and are injection molded with tough black nylon. Although they're lightweight, they're designed to handle the extra stress of large truck wheels and the added shock load. The arms push the front wheelbase out almost to the maximum limit, and the added width improves stability. All RPM products are guaranteed not to break!

Price: \$11.95/pair

Part no. 7350



Yokomo Nylon Rear Carriers

RPM now makes rear bearing carriers for the Yokomo YZ-10. They're molded of tough nylon, have RPM's famous "finished look" and are 30 percent lighter than stock! To reduce suspension play, the arm fits the hinge pin precisely. You can use either flanged or non-flanged bearings, and the bearing bores fit snugly and are aligned perfectly.

Price: \$7.95/pair

Part no. 7515

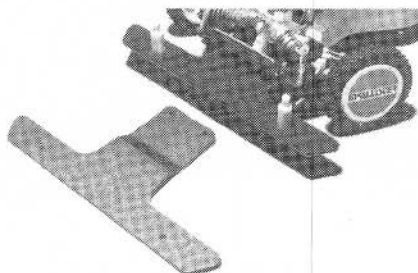
For more information, contact RPM., 14978 Sierra Bonita Ln., Chino, CA 91710.



McALLISTER "Sideways" ASA Pontiac Body

Developed by short-track-oval ace Mike Johns, from "Sideways" City in Wayland, MI, this body combines the sleek look of the ASA stockers with the aerodynamics to run quickly and handle the grind of short-track paved-oval racing.

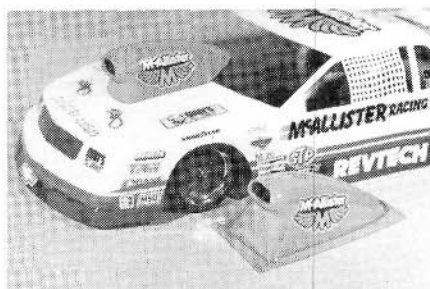
Part no. B-144



RC10 Front Bumper/Body Mount

This contoured front bumper fits accurately and is made of high-impact Kydex for both aluminum and graphite RC10 kits. It's great for dirt or pavement.

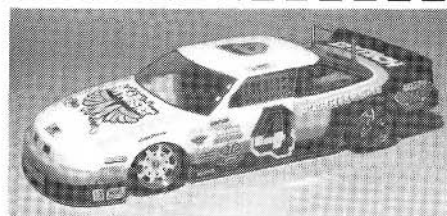
Part no. A-433



"Pro Scoop"

For a true scale look, mount this universal, pro-stock hood scoop on your favorite door slammer, and you'll be ready to do the scale quarter-mile in a record time!

Part no. A-432



Narrow Width Olds Stocker

A true scale appearance and super detail make this '90 Olds stocker a stand-out! It features a narrow width for reduced aerodynamic drag on fast oval tracks.

Part no. B-141

For more information, contact McAllister Racing, 2245 First St., Unit 105, Simi Valley, CA 93065.



CUSTOM R/C GRAPHIX "One Coat" Masking Film

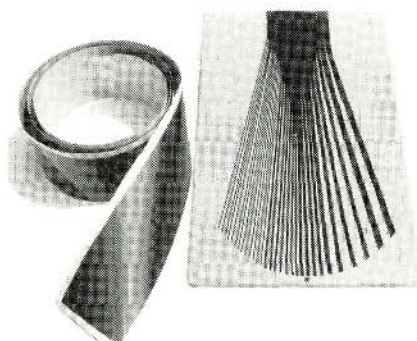
You can apply this liquid "One Coat" masking film by using brush, spray or wash-on methods. It's concentrated and protects surfaces from overspray during painting. Drying times are as low as 1/2 hour, depending on the application thickness and the drying method. Use this non-toxic liquid on plastic, Lexan, metals, ceramics and acetate overlays. If necessary, you can thin it.

Price: 8 ounces, \$4.15; 16 ounces, \$6.15; 32 ounces, \$7.95.

For more information, contact Custom R/C Graphix, 4138 Boston Rd., Bronx, NY 10475.

(Continued on page 226)

WHAT'S NEW



CUSTOM R/C GRAPHIX Pin Line Tape

This 2-mil, pressure-sensitive, superflex vinyl Pin Line Tape comes in 79 colors, including five hot fluorescents! Each color is available in 48-inch rolls that have 31 pin stripes in $\frac{1}{32}$ -, $\frac{1}{16}$ -, $\frac{3}{32}$ -, $\frac{1}{8}$ - and $\frac{3}{16}$ -inch widths. This fuelproof, waterproof, colorfast tape provides super flexibility for all your fine-line trimming and highlighting.

Price: \$5/roll

For more information, contact Custom R/C Graphix, 4138 Boston Rd., Bronx, NY 10475.

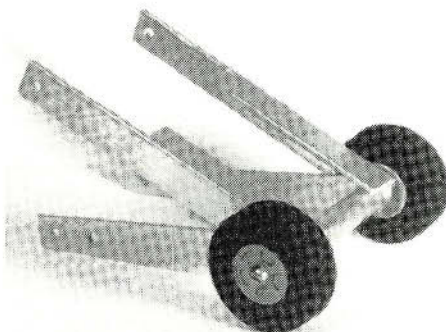


ESP Clod Buster Front Bumper with Brush Guard

ESP's twin-tube front bumper with brush guard is new for the Tamiya Clod Buster. It features heavy-duty, solid-aluminum construction with a built-in brush guard, and it bolts on without any modifications.

Price: \$24.95

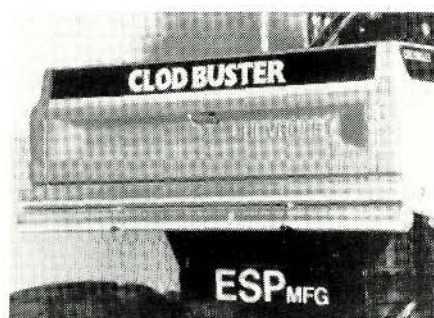
Part no. ESP 006



Clodzilla Wheelie Bar

ESP's new wheelie bar bolts right onto the Clod Buster gear case and enables the truck to do wheelies or climb without falling over backwards.

Price: \$24.95



Clod Buster Twin-Tube Rear Bumper

ESP now makes a high-style, twin-tube rear bumper for the Clod Buster. It has all-aluminum construction and is a perfect bolt-on match for the ESP front bumper.

Price: \$14.95

Part no. ESP 007

For more information, contact ESP Manufacturing, Inc., 7105 Virginia Rd., Crystal Lake, IL 60014.



KYOSHO Indy Penske PC-19 Pennzoil

Experience authentic Indy car action in $\frac{1}{10}$ scale with the Indy Penske PC-19 Pennzoil. The Penske PC19 features a realistically detailed suspension system and body that have been scaled down

from a real Indy race car. It includes a speed controller with three forward speeds and one reverse and a powerful electric motor.

Price: \$199.95



Nissan 300ZX

Kyosho announces a realistic $\frac{1}{10}$ -scale model of the high-performance Nissan 300ZX sports car. Based on the proven Ultima 2WD chassis, it features glass-reinforced independent suspension with oil-filled shocks, an accurately molded Lexan body, radial-pattern tires and scale wheels.

Price: \$199.95

For more information, contact Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.



TEAM ASSOCIATED Racing Silicone Shock Oil

Associated offers racing silicone shock oil in the following weights: 10WT (no. 5420); 20WT (no. 5421); 30WT (no. 5422); 40WT (no. 5423), 80WT (5425).

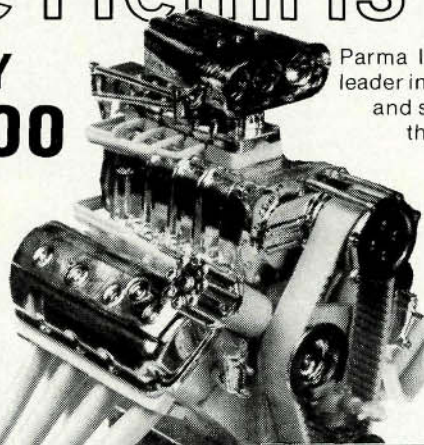
Price: \$3.50/ 2 ounce bottle

For more information, contact Associated Electric, 3585 Cadillac Ave., Costa Mesa, CA 92626.

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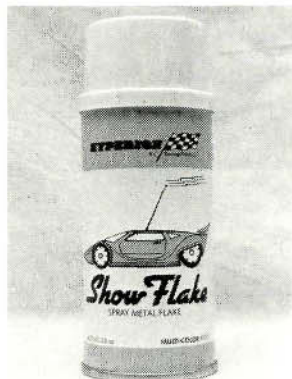
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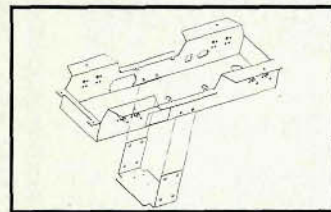
(Continued on page 242)



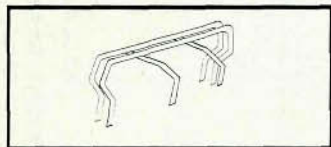
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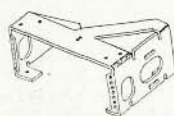
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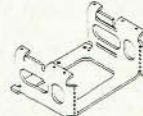
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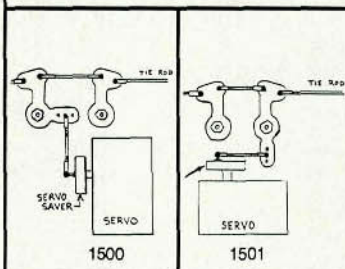


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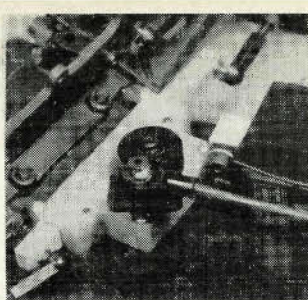


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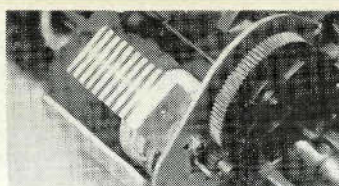
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(Continued from page 240)

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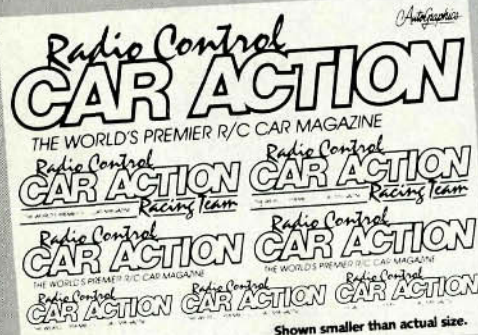
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ADVERTISER INDEX

AAA Model Supply	78
A&L Manufacturing	112
Ace Hardware	145
Action Video's Inc.	64
Actra Manufacturing	77
A.J.'s R/C	154
America's Hobby Center	228
Andy's R/C Products	82
Associated Electric	36-37, 112, 129, 166, C3
Astro-Flight	8-9
Autographics of California	75
B&B Software	208
B&R MotorWorks	207
B&T Racing	208
Badger Air-Brush	176, 200
Ballistic Batteries	133
B.I.R. Hobby Shops	162
Boca Bearing Co.	50
Bolink R/C Cars, Inc.	211
Bud's Racing Products	198
California Cheap Skates	168
Central Model Marketing	174
Cheetah Racing	167
Cinema One Video	99
Class Recreational Products	186
Cobra International	98
Competition Battery Sales	51
Competition Electronics, Inc.	177
Coverite	7
Cox Hobbies	4
Dahm's Racing Bodies	27
Dan's RC Stuff	162
Dialed Racing Products	50
Doctor J's R/C Warehouse	144
Dolanite Custom Graphics	238
Dream Station Hobbies	230
EMCO Maier	173
Endurance Racing Products	187
ERI	90
ESP, Inc.	98
Fall Hobbies	75
Futaba Corp.	67, 155
Global Hobbies	97, 209
Great Northern Hobbies	212-219
Hitec	119

Hobbico	10, 167, 190
Hobby Dynamics Distributors	154
Hobby Products International	30
Hobby Shack	222-225
Hole Shot Racing	144
Horizon Hobby Distributors	22
Hyperion	238
Imex Model Co., Inc.	107, 169
Island Hobbies	78
J.G. Manufacturing	73, 143
Kimbrough Products	142
Kyosho	C2, 41, 126, 150, 199
Leading Edge	230
Litespeed	122
Mail Order Form	205
McAllister Racing	29
MK Model Products	192
Model Craft Manufacturing	102
Model Rectifier Corporation	31, C4
MRP	11, 153
Novak Electronics	92
N.W. Model Expo '91	146
Ocean Pacific Ent.	152
Omni Models	120-121
PanaVise Products	146
Paragon Racing Products	77
Parma International	65, 87, 189, 230
Periphex	198
Power-Graphix	206
ProCell	208
ProLine U.S.A.	55
Quarterflash	131
Racer's Choice R/C	168
Radio Active Models	146
RAM	123
R.C.B.M. Subscription	229
R.C.C.A. Action Series Subscription	35
R.C.C.A. Back Issues	160-161
R.C.C.A. Beginner Pak	195
R.C.C.A. Books	196-197
R.C.C.A. 1991 Buyers' Guide	111
R.C.C.A. Chronometers	175
R.C.C.A. Decals	242
R.C.C.A. Off-Road	204
R.C.C.A. Product Line	164-165

R.C.C.A. Subscription	18
R.C.C.A. Watches	123
RCD Inc.	114
R.C. Direct	52-53
R/C Graphix	168
R/C International	170-171
RCK	206
Retailer Ad	238
RichMan's Toys	133
Robinson Racing Products	113, 227
Sanyo Energy Corp.	156-157
Sassy Chassis	195, 240
SCI Corporation	17
Sees Precision Machine Works	195
Serpent	172
Sheldon's Hobbies	231-237
Sherline	79
Southside Hobbies	210
S.S. Industries	238
Stage III	25
Stormer Hobbies	28, 71
Tammie's Hobbies	239
Team Losi	88-89, 193
Tekin Electronics, Inc.	141
TeleVideo Productions	110
The Finest R/C	201-203
Thorp Manufacturing, Inc.	26, 188
TMS Products	159
Top Dog Parts	146
Top Gear Mfg.	176
Tower Hobbies	178-185
Track Master	241
Traxxas Corporation	57, 90, 191
TRC	91
Trinity Products	3, 42-43, 147
Twinn-K	64
Twister Motors	66
Ultra	163
Ungar	51
Victor Engineering	194
Walt's Hobby	110
Wanted	131
Winning Edge	242